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# Systematics of the Genus *Eumops* (Chiroptera: Molossidae)

Judith L. Eger

ROM

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JUDITH L. EGER is a Curatorial Assistant in the Department of Mammalogy, Royal Ontario Museum.

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*Contents*

# Systematics of the Genus *Eumops* (Chiroptera: Molossidae)


**Abstract**

Bats of the genus *Eumops* range from the southern United States to central Argentina. In this study, 11 operational taxonomic units (OTUs) were designated within the genus; *Eumops auripendulus*, *E. bonariensis*, *E. dabbenei*, *E. glaucinus glaucinus*, *E. g. floridanus*, *E. hansae*, *E. maurus*, *E. perotis perotis*, *E. p. californicus*, *E. trumbulli*, and *E. underwoodi*.

A systematic examination of the genus based on morphometric characters included analyses of sexual dimorphism, relationships among all OTUs, and geographic variation. Males were larger than females in seven taxa examined for sexual dimorphism.

Phenetic relationships among OTUs were assessed using cluster analysis and principal component analysis. These numerical taxonomic techniques established nine species within the genus: *Eumops auripendulus*, *E. bonariensis*, *E. dabbenei*, *E. glaucinus*, *E. hansae*, *E. maurus*, *E. perotis*, *E. trumbulli*, and *E. underwoodi*.

Geographic variation was studied in *Eumops auripendulus* and *E. g. glaucinus*, using discriminant functions analysis and in addition using Sum of Squares Simultaneous Testing Procedure analysis in *E. glaucinus*. These analyses indicate that *E. auripendulus* and *E. glaucinus* have each differentiated into two subspecies.


## *Introduction*

Bats of the genus *Eumops*, widely distributed in the Americas and most abundant in the Neotropical region, occur from southern areas of California, Arizona, Texas, and Florida, throughout Mexico and Central America, and south to central Argentina. Populations of *Eumops* are also found in Cuba and Jamaica in the Greater Antilles and in Trinidad. Although widely distributed geographically, these bats are not numerous in collections.

The altitudinal and ecological distributions of *Eumops* are also great, as species occur at elevations ranging from sea level to 3,000 m, in tropical rain forest, deciduous forest, savanna, and montane environments. *Eumops* roosts in rocks, cliffs, attics of buildings, and hollow trees (Walker, 1968), but little is known of its natural history other than Barbour and Davis's (1969) review of *Eumops perotis californicus*. All species are considered to be insectivorous, but only *E. perotis californicus* is known to eat insects (Ross, 1961; Easterla and Whitaker, 1972).

*Eumops*, in common with other genera of the family Molossidae, has a tail that extends beyond the posterior margin of the uropatagium, hence the common name "free-tail bats". Features diagnostic of the genus include large, rounded pinnae that arise from a single point or are joined medially on the forehead. Smooth upper lips distinguish *Eumops* from the genus *Tadarida*. The antitragus is well developed, and the tragus is either small and pointed or broad and square. All species possess a gular gland that is well developed in males but rudimentary in females. Species vary in size from *E. bonariensis*, with a minimum forearm length of 37 mm, to *E. perotis*, with a maximum forearm length of 83 mm. The shape of the skull is cylindrical; basisphenoid pits are well developed. The upper incisors are slender, with a curved shaft. The palate is slightly arched, as compared with the domed palate of species of the genus *Promops*. The length of the third commissure of the third upper molar has been used as a taxonomic character to group species of the family. African bats of the genus *Tadarida*, for example, were divided into subgenera partially on the length of the third commissure (Hayman and Hill, 1971). Species of *Eumops* may be divided into four groups according to the degree of development of the third commissure: 1) lacking, 2) rudimentary, 3) one-fourth to one-half the length of the second commissure, and 4) same length as the second commissure.

The dental formula for the genus is: $\frac{1}{2}, \frac{1}{1}, \frac{1 \text{ or } 2}{2}, \frac{3}{3}$

Miller (1906) established the genus *Eumops* and included 10 species of molossids that had previously been placed in the genera *Molossus* and *Promops*. Sanborn (1932) reviewed the taxonomy of *Eumops* and reduced the number of species to six: *E. abrasus*, *E. bonariensis*, *E. glaucinus*, *E. hansae*, *E. maurus*, and *E. perotis*. Since 1932 other species have been described: *E. underwoodi* (Goodwin, 1940), *E. sonoriensis* (Benson, 1947), *E. amazonicus* (Handley, 1955), and *E. geijskesi* (Husson, 1962).

I initiated this study to examine variation within the genus and to clarify the phenetic relationships in this group of molossids. I placed particular emphasis on providing a phenetic classification based on similarity in size and shape among taxa assessed over numerous characters. Such an approach has not been carried out for *Eumops* heretofore. A prime objective was to compare results of numerical with those of traditional taxonomy. Numerical taxonomic methods have been used in other studies of bat systematics, exemplary studies being those of Baker *et al.* (1972a), Findley (1972), and Smith (1972).

In addition to a numerical taxonomic study of the genus, this study included a review of geographic variation within *E. auripendulus* and *E. glaucinus*. Finally, results of these studies were incorporated in a critical review and revision of the genus *Eumops*.

## *Materials and Methods*

Specimens studied were either prepared study skins and skulls or preserved in alcohol (some with skulls removed). Specimens examined are in the collections of the following institutions: American Museum of Natural History (AMNH); The Academy of Natural Sciences, Philadelphia (ANSP); Bell Museum of Natural History, University of Minnesota, Minneapolis (MMNH); British Museum (Natural History) (BMNH); Carnegie Museum (CM); Dallas Museum of Natural History (DMNH); Field Museum of Natural History (FMNH); Institute of Jamaica (IJ); Institut Royal des Sciences Naturelles de Belgique (IRSNB); The Museum of Natural History, University of Kansas (KU); Los Angeles County Museum (LACM); Louisiana State University Museum of Zoology, Baton Rouge (LSU); Museum of Comparative Zoology, Harvard University (MCZ); Museo de Historia Natural Uniandes, Universidad de los Andes, Bogotá (MHNU); Muséum National d'Histoire Naturelle, Paris and Brunoy (MNHN); Museum of Southwestern Biology, University of New Mexico, Albuquerque (MSB); Museum of Vertebrate Zoology, University of California, Berkeley (MVZ); Rijksmuseum van Naturlijke Historie, Leiden (RMNH); Royal Ontario Museum (ROM); Texas Cooperative Wildlife Research Collection, Texas A&M University (TCWC); The Museum, Texas Tech University, Lubbock (TTU); Universidade de São Paulo (USP); University of Arizona Department of Biological Sciences (UA); University of Illinois Museum of Natural History (UI); University of Miami Department of Zoology (UM); University of Michigan Museum of Zoology (UMMZ); Universidad Nacional Autónoma de México (UNAM); National Museum Natural History (USNM); Universidad de Valle, Cali (UCV); Yale Peabody Museum (YPM).

Thirty-two morphological characters were measured as follows:

*External*

1. Forearm length (FOAR), distance from the wrist to the elbow, including the skin.
2. Third digit metacarpal length (3DME), distance from the wrist, including the skin, to the metacarpal-phalangeal joint.
3. First phalanx length (1PHL), distance from the metacarpal-phalangeal joint to the distal end of the first phalanx of the third digit.
4. Second phalanx length (2PHL), distance from the proximal to the distal end of the second phalanx of the third digit.
5. Fourth digit metacarpal length (4DME).
6. First phalanx length (1PHL), of the fourth digit.
7. Second phalanx length (2PHL), of the fourth digit.
8. Fifth digit metacarpal length (5DME).
9. First phalanx length (1PHL), of the fifth digit.
10. Second phalanx length (2PHL), of the fifth digit.
11. Tail vertebrae (TVER), length of tail vertebrae.
12. Ear length (EARS), distance from the base of the notch to the uppermost margin of the pinna.
13. Tibia length (TIBI), distance from the tibia-femur joint to the tibia-tarsal joint.

*Mandible*

14. Condyloincisive length (CIMA), distance from the condyles to the anterior face of the incisors.
15. Greatest length (GRLG), distance from one condyle to the anterior face of the incisors.
16. Mandibular toothrow length ($C\text{-}M_3$), distance from the canine to the third molar.
17. Canine width ($C_1\text{-}C_1$), width across the canines, including cingula.

*Skull*

18. Septum width between basisphenoid pits (WBSP), minimum distance across the septum.
19. Basisphenoid pit length (LBSP), distance from the anterior to posterior edge of the basisphenoid pit.
20. Skull length (TOLG), distance from the lambdoid crest to the anterior face of the incisors.
21. Condyloincisive length (CBLG), distance from the occipital condyles to the anterior face of the incisors.
22. Palatal length (PALA), distance from the anterior face of the incisors to the posterior margin of the palate lateral to the posteromedial projection.
23. Zygomatic width (ZYGO), distance between the zygomatic arches measured on the squamosal bones.
24. Mastoid width (MAST), greatest width at the mastoid processes.
25. Lachrymal width (LACH), distance across the lachrymal processes.
26. Interorbital width (IOWI), distance between the orbits measured below the lachrymal processes.
27. Braincase height (HBCA), distance from the ventral border of the foramen magnum to the parietal, excluding the saggital crest.
28. Width across the third molars ($M^3\text{-}M^3$), distance across the crowns of the third molars.
29. Maxillary toothrow ($C\text{-}M^3$), distance from the anterior face of the canine to the posterior edge of the third molar.
30. Canine width ($C^1\text{-}C^1$), width across the canines including cingula.
31. Postorbital constriction (POCO), minimum interorbital distance measured across the frontals.
32. Braincase breadth (BBC2), maximum width measured dorsal to the auditory bullae with the blades of the callipers resting on the zygoma.

Six other characters were measured, as follows:

33. Total length (TOLG), distance from the tip of the nose to the tip of the tail.
34. Hindfoot (HDFT), distance from the heel to the tips of the claws.
35. Tragus length (TRAG), measured from the base to the tip.
36. Height of lower canine (HTLC), measured buccally from the base of the cingulum to the crown.
37. Height of the upper canine (HTUC), measured buccally from the base of the cingulum to the crown.
38. Braincase width (BBC1), anterior width of the braincase measured where the zygoma anastamose with the parietals.

These six characters were not available for approximately 25 per cent of the specimens and therefore were not used in all multivariate analyses, which generally require complete data matrices.

Measurements were taken with dial calipers to the nearest 0.1 mm for wing bones, the nearest mm for body measurements, and the nearest 0.05 mm for cranial measurements. The length of the tibia, often difficult to measure, was verified by radiographs where possible. Descriptions of pelage colour follow those given by Ridgway (1912).

Mensural data were supplemented by additional information (reproductive condition, age, weight, locality, elevation, and habitat) from specimens or labels. If the specimen was a prepared skin and skull, external measurements were recorded if given; if the specimen was preserved in alcohol, body measurements were taken. Only data from adult specimens were used in statistical analysis. Adults were considered to be individuals with complete fusion of epiphyses of metacarpals and phalanges and with complete fusion of the sphenoid bones in the skull.

Bats of the genus *Eumops* are currently divided into 16 discrete taxa with subspecies as the basic units. But to study interspecific variation, subspecies of a species were grouped where distributions of subspecies are continuous, e.g., *E. bonariensis*. Where subspecies are geographically isolated, e.g., *E. glaucinus glaucinus* and *E. g. floridanus*, or when the status of a taxon is in question, e.g., *E. trumbulli*, subspecies were used as OTUs (Operational Taxonomic Units; Sneath and Sokal, 1973). Table 1 lists the 11 OTUs studied and gives the geographic distribution of each. For *E. g. floridanus* only males were available and for *E. dabbenei* only females were available.

### Grouping Procedures for Analysis of Geographic Variation

Sufficiently large samples were available only for *E. auripendulus* and *E. glaucinus* to allow examination of geographic variation. Where possible, bats from distinct localities were used as the basic unit, but as some samples were small, several contiguous localities were grouped to yield larger samples after considering likely geographic or ecological barriers that might limit dispersal (see Tables 4–6). Geographic distributions of these two taxa are illustrated in Fig. 15 and 21.

### Statistical Methods

The following analyses were made on the IBM/370 computer at the University of Toronto Computer Centre. Sample sizes of males and females of seven taxa were sufficiently large to test for sexual dimorphism: *Eumops a. auripendulus*, *E. bonariensis beckeri*, *E. g. glaucinus*, *E. p. perotis*, *E. p. californicus*, *E. trumbulli*, and *E. underwoodi sonoriensis*.

Differences in character variability between sexes were tested for significance within OTUs by the $F$-test of variance ratios (Sokal and Rohlf, 1969). Differences in character means between males and females were examined using Student's $t$-test (Sokal and Rohlf, 1969); the formula for equal or unequal sample variances was used according to results of the $F$-test of the variance ratio. Phenetic relationships among OTUs were assessed using two types of

Table 1. **Sample details for OTUs of *Eumops* used in this study**

| OTU | Distribution and Number |
|---|---|
| 1. *E. auripendulus* (EAUR) n = 307; 85 ♂♂, 222 ♀♀ | Argentina (6), Brazil (79), Belize (1), Colombia (33), Costa Rica (62), Ecuador (4), El Salvador (1), French Guiana (3), Guatemala (1), Guyana (30), Honduras (10), Jamaica (1), Nicaragua (1), Panama (28), Peru (17), Surinam (12), Trinidad (1), Venezuela (17) |
| 2. *E. bonariensis* (EBON) n = 157; 64 ♂♂, 93 ♀♀ | Argentina (14), Bolivia (38), Brazil (7), Colombia (11), Guyana (5), Honduras (1), Mexico (6), Panama (5), Paraguay (58), Peru (1), Venezuela (2) |
| 3. *E. dabbenei* (EDAB) n = 3 ♀♀ | Argentina (1), Colombia (1), Venezuela (1) |
| 4. *E. g. glaucinus* (EGGL) n = 246; 86 ♂♂, 160 ♀♀ | Bolivia (2), Brazil (11), Colombia (32), Costa Rica (24), Cuba (33), Ecuador (2), Guyana (16), Honduras (6), Jamaica (9), Mexico (33), Nicaragua (1), Panama (2), Paraguay (3), Peru (14), Venezuela (58) |
| 5. *E. glaucinus floridanus* (EGFL) n = 21 ♂♂ | Florida (21) |
| 6. *E. hansae* (EHAN) n = 8; 3 ♂♂, 5 ♀♀ | Brazil (2), Costa Rica (1), Guyana (3), Panama (1), Venezuela (1) |
| 7. *E. maurus* (EMAU) n = 3; 1 ♂, 2 ♀♀ | Guyana (1), Surinam (2) |
| 8. *E. p. perotis* (EPPE) n = 60; 22 ♂♂, 38 ♀♀ | Argentina (29), Brazil (29), Venezuela (2) |
| 9. *E. perotis californicus* (EPCA) n = 157; 46 ♂♂, 111 ♀♀ | Mexico (9), United States (148) |
| 10. *E. trumbulli* (ETRU) n = 55; 23 ♂♂, 32 ♀♀ | Brazil (16), Colombia (22), Guyana (6), Peru (6), Surinam (1), Venezuela (4) |
| 11. *E. underwoodi* (EUND) n = 72; 28 ♂♂, 44 ♀♀ | Belize (3), Honduras (4), Mexico (51), United States (14) |

multivariate techniques: an R-mode analysis of correlations among characters and a Q-mode analysis of correlations or distances between pairs of OTUs.

### R-MODE ANALYSIS

Principal components can be extracted from a matrix of correlations among characters and can be presented as three-dimensional models of OTUs (Sneath and Sokal, 1973). In this study the components represent a set of new orthogonal axes in 32-dimensional character space. The first principal component explains maximum character variance; the second is orthogonal (uncorrelated) to the first and is placed so that it explains a maximum of the remaining character variance; and the third is orthogonal to the first and second. The resulting 3-D model usually represents relationships among OTUs accurately although there may be some distortion of distances among similar OTUs. To detect possible distortion, a shortest minimally connected network (Rohlf, 1970) can be computed from the original distance matrix and superimposed on the 3-D model. Two principal component analyses were performed, one using standardized data and the other using data divided by forearm length (before standardization) to reduce the overall effect of size (see Robins and Schnell, 1971).

### Q-MODE ANALYSIS

Average taxonomic distance coefficients and correlation coefficients were calculated for all pairs of OTUs using standardized data (mean of zero and a standard deviation of one). Average linkage cluster analysis (unweighted pair-group method, UPGMA, Sneath and Sokal, 1973) was performed on the distance and correlation matrices, and results were summarized in phenograms. The UPGMA method was used because it produces the highest correlation between a phenogram and its similarity matrix (cophenetic correlation, see Sneath and Sokal, 1973). For some analyses, all measurements were divided (before standardization) by forearm length to reduce the effect of size on the resultant clustering. Cophenetic correlation coefficients were calculated for each phenogram.

As the first principal component is often a general size factor, I also tried to reduce the effect of size in forming clusters by removing the first principal component from a matrix of distances between OTUs (see Robins and Schnell, 1971). The coefficient of correlation of cophenetic values (Crovello, 1969) was calculated to compare phenograms resulting from different methods of analysis. The above procedures were carried out by programmes in NT-SYS written by F. J. Rohlf and associates at Stoney Brook, S.U.N.Y.

### INTRASPECIFIC VARIATION

Intraspecific variation was assessed in female *E. auripendulus*. Total length, tail vertebrae, and tragus were not included in the multivariate analysis. The approach was to consider all characters simultaneously to test for difference among locality samples by multivariate analysis of variance (Wilks' likelihood ratio method), and to assess the relative positions of localities in multidimensional character space by generalized discriminant functions analysis (Cooley and Lohnes, 1971; Seal, 1966). Ninety-five per cent confidence circles for the centroids were constructed (Seal, 1966) to indicate the degree of overlap among samples. Discriminant functions analysis requires complete data matrices, and values of missing characters were estimated by linear regression. The character that had the highest correlation (based on the pooled sample) with the missing measurement was used in a linear regression equation to provide the best least-squares estimate of the missing value.

Intraspecific variation in female *E. glaucinus* was examined by discriminant functions analysis and in males by multiple comparison tests, Gabriel's (1964)

Sum of Squares Simultaneous Test Procedure (SS-STP). Application of SS-STP to geographic variation was discussed by Gabriel and Sokal (1969). I followed Power (1970) and arranged means in decreasing order of magnitude rather than considering only those samples from contiguous localities. For each locality the mean, standard error, standard deviation, coefficient of variation, and range were calculated for all 38 characters. (These statistics are on file, Department of Mammalogy, ROM.)

The above multivariate procedures were carried out using programmes on file in the Department of Mammalogy, ROM: Missing data estimator (MDE), and Discriminant functions analysis (Canan).

## *Results*

**Sexual Dimorphism**

Of the 16 taxa studied, sample sizes of males and females of *E. a. auripendulus*, *E. bonariensis beckeri*, *E. g. glaucinus*, *E. perotis californicus*, *E. p. perotis*, *E. trumbulli*, and *E. underwoodi sonoriensis* were sufficiently large to test sexual dimorphism. These seven taxa exhibited statistically significant dimorphism, with *E. bonariensis beckeri* being the least dimorphic (26 per cent of characters) and *E. p. perotis* the most dimorphic (68 per cent of characters). Length of mandible and skull were consistently dimorphic in all seven OTUs. Dimorphism in external body measurements was generally absent. Among cranial characters, basisphenoid pits, breadth of skull, and postorbital constriction show little dimorphism. For dimorphic characters males were consistently larger than females, and in the ensuing sections males and females were therefore treated separately.

**Principal Component Analysis**

Principal components I and II account for 89.12 and 5.86 per cent of total character variation for males and 90.64 and 5.63 per cent for females. Hence, with 95 per cent of the total variance explained, a reduction of character space to two dimensions should not distort distances between OTUs (Fig. 1 and 2). Principal component I is generally a size factor with high loadings on all characters except length of basisphenoid pit and width of septum (Table 2) and separates the small, medium, and large OTUs. The basisphenoid pit characters have high loadings on the second component and separate *E. bonariensis* from *E. maurus* and *E. p. perotis*, *E. trumbulli*, and *E. p. californicus* from *E. underwoodi*. Figures 3 and 4 illustrate results of principal component analysis (PCA) on characters divided by forearm length. The first three principal components explain 57.93, 16.44, and 10.14 per cent of the variance (males) and 45.40, 24.15, and 11.67 per cent (females). In both males and females, principal component I separates *E. hansae* and *E. maurus* from the remaining OTUs and is a contrast between skull and wing measurements (see Table 3). Principal component II has high loadings for ear length and separates *E. perotis* and *E. trumbulli* from the other taxa. Characters contributing to the high loadings on component III are not consistent in males and females. In males there are high

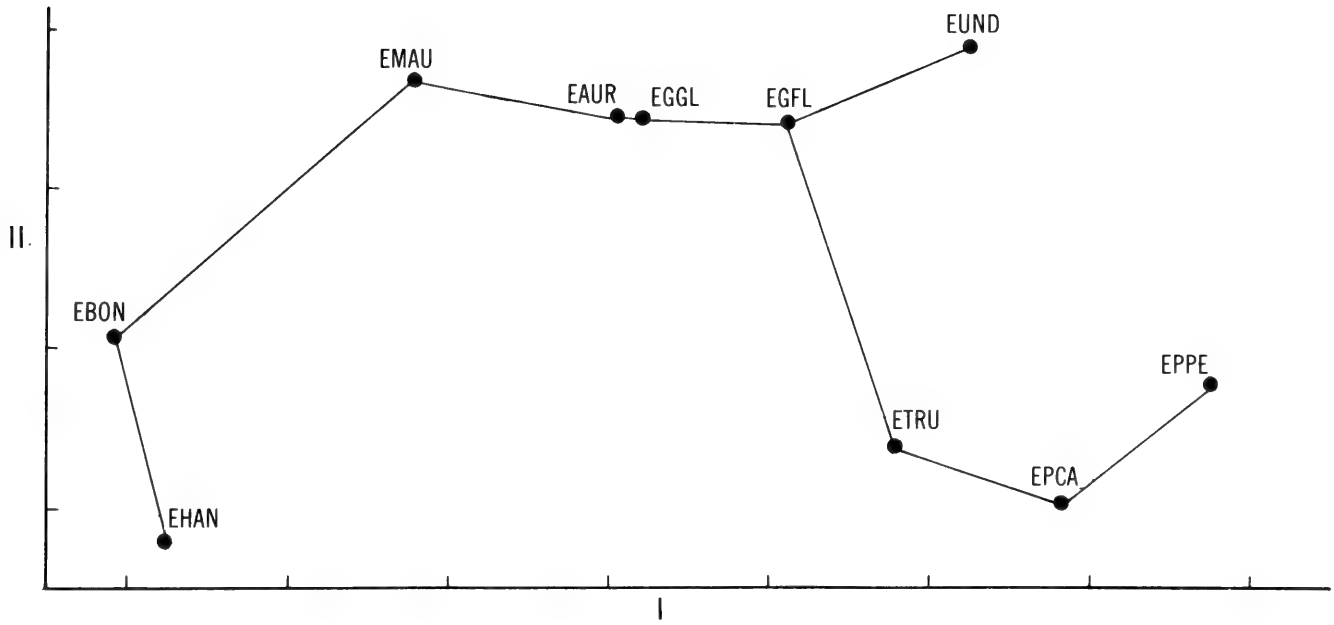


Fig. 1. OTUs of male *Eumops* projected onto the first two principal components of a matrix of correlations among characters with a minimum spanning tree superimposed upon the OTUs. See Table 1 for explanation of abbreviations.

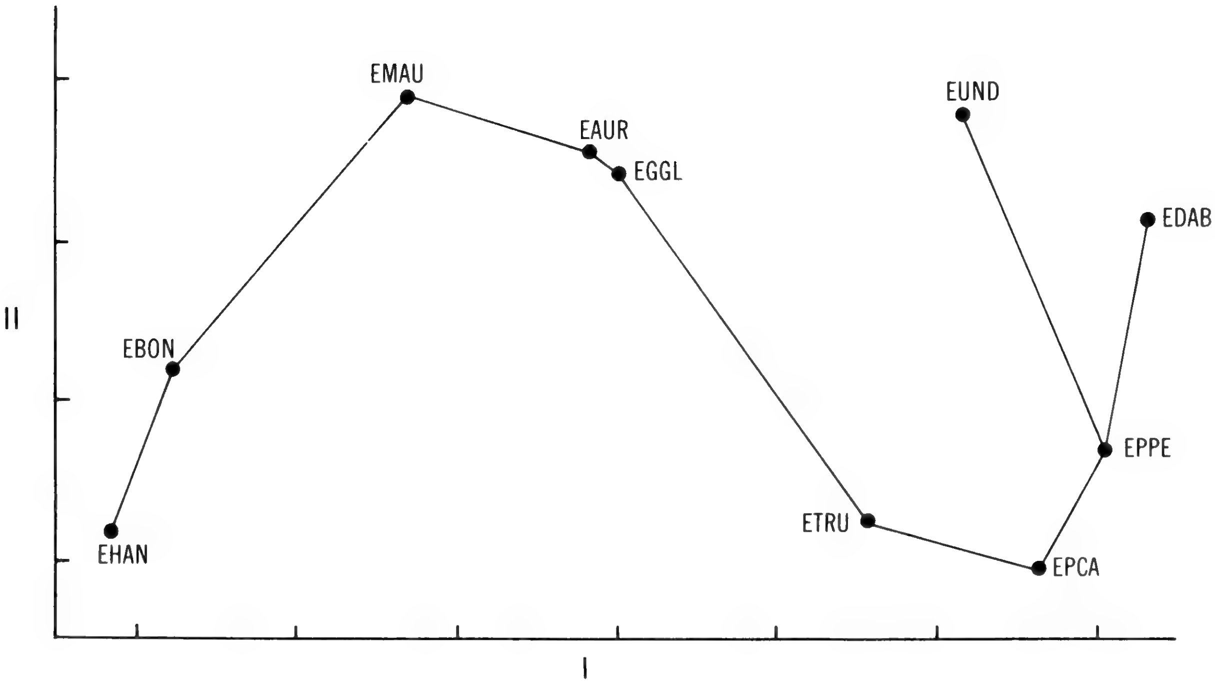


Fig. 2. OTUs of female *Eumops* projected onto the first two principal components of a matrix of correlations among characters with a minimum spanning tree superimposed upon the OTUs. See Table 1 for explanation of abbreviations.

Table 2. **Loadings of characters for the first two principal components based on matrices of correlations among characters of male and female *Eumops***

| | ♂♂ | | ♀♀ | |
|---|---|---|---|---|
| Character | I | II | I | II |
| FOAR | 0.992 | −0.020 | 0.991 | −0.041 |
| 3DME | 0.991 | −0.008 | 0.992 | −0.015 |
| 1PHL | 0.984 | 0.107 | 0.984 | 0.111 |
| 2PHL | 0.971 | 0.178 | 0.992 | 0.074 |
| 4DME | 0.988 | 0.005 | 0.992 | −0.018 |
| 1PHL | 0.973 | 0.152 | 0.979 | 0.103 |
| 2PHL | 0.768 | 0.375 | 0.812 | 0.461 |
| 5DME | 0.978 | 0.028 | 0.984 | 0.002 |
| 1PHL | 0.972 | 0.140 | 0.980 | 0.004 |
| 2PHL | 0.920 | 0.157 | 0.979 | −0.007 |
| TVER | 0.944 | 0.159 | 0.975 | 0.085 |
| EARS | 0.857 | −0.462 | 0.826 | −0.478 |
| TIBI | 0.942 | 0.103 | 0.969 | 0.031 |
| WBSP | 0.379 | 0.872 | 0.260 | 0.883 |
| LBSP | 0.717 | −0.673 | 0.720 | −0.666 |
| CIMA | 0.989 | −0.128 | 0.994 | −0.084 |
| GRLG | 0.991 | −0.119 | 0.992 | −0.093 |
| $C\text{-}M_3$ | 0.999 | −0.029 | 0.999 | −0.003 |
| $C_1\text{-}C_1$ | 0.965 | −0.083 | 0.957 | 0.112 |
| TOLG | 0.988 | −0.131 | 0.992 | −0.085 |
| CBLG | 0.984 | −0.160 | 0.987 | −0.137 |
| PALA | 0.989 | −0.099 | 0.993 | −0.057 |
| ZYGO | 0.990 | −0.042 | 0.996 | −0.008 |
| MAST | 0.975 | −0.032 | 0.989 | 0.006 |
| LACH | 0.953 | −0.010 | 0.962 | 0.030 |
| IOWI | 0.962 | −0.023 | 0.964 | 0.059 |
| HBCA | 0.950 | 0.207 | 0.966 | 0.200 |
| $M^3\text{-}M^3$ | 0.995 | −0.032 | 0.998 | 0.002 |
| $C\text{-}M^3$ | 0.996 | −0.074 | 0.998 | −0.057 |
| $C^1\text{-}C^1$ | 0.988 | −0.056 | 0.991 | −0.045 |
| POCO | 0.897 | 0.126 | 0.941 | 0.149 |
| BBC2 | 0.986 | −0.004 | 0.997 | −0.021 |
| Percent Variance Explained | 89.12 | 5.86 | 90.64 | 5.73 |

positive loadings of metacarpals and low positive values for width of skull characters. Females show this same contrast between length and width of skull, but only the metacarpal and second phalanx of the fifth digit have high positive loadings.

**Cluster Analysis**

The distance phenogram for males (Fig. 5) divides the OTUs into three main groups: *E. auripendulus*, *E. g. glaucinus*, *E. g. floridanus*, and *E. maurus*; *E. p. perotis*, *E. p. californicus*, and *E. trumbulli*; *E. bonariensis* and *E. hansae*. Similarly, clusters in the phenogram for females (Fig. 5) consist of *E. auripendulus*, *E. glaucinus*, and *E. maurus*; *E. bonariensis* and *E. hansae*; and *E. p.*

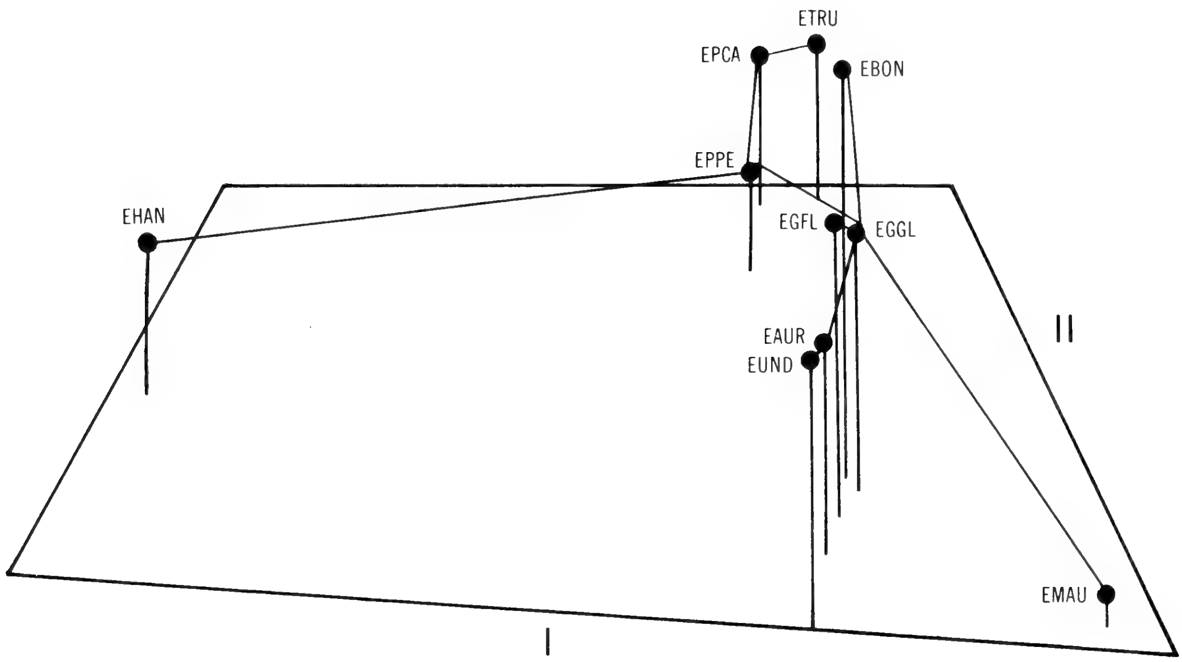


Fig. 3. OTUs of male *Eumops* projected onto the first three principal components of a matrix of correlations among characters divided by forearm length with a minimum spanning tree superimposed upon the OTUs. See Table 1 for explanation of abbreviations.

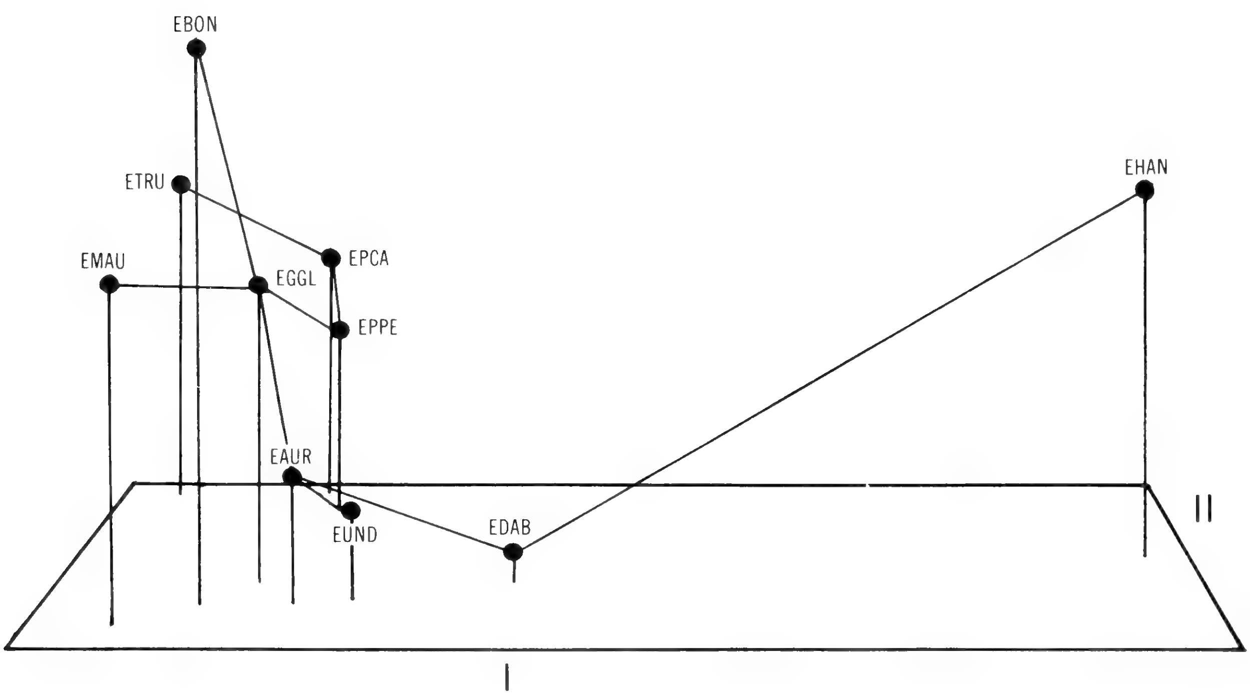


Fig. 4. OTUs of female *Eumops* projected onto the first three principal components of a matrix of correlations among characters divided by forearm length with a minimum spanning tree superimposed upon the OTUs. See Table 1 for explanation of abbreviations.

Table 3. Loadings of characters/forearm for the first three principal components based on matrices of correlations among characters of male and female *Eumops*

| | ♂♂ | | | ♀♀ | | |
|---|---|---|---|---|---|---|
| Character | I | II | III | I | II | III |
| 3DME | 0.423 | −0.062 | 0.745 | 0.155 | −0.928 | 0.221 |
| 1PHL | 0.608 | −0.547 | −0.267 | −0.326 | −0.715 | −0.360 |
| 2PHL | 0.838 | −0.366 | −0.070 | −0.101 | −0.535 | −0.653 |
| 4DME | 0.734 | 0.051 | 0.620 | −0.285 | −0.630 | 0.019 |
| 1PHL | 0.698 | −0.504 | −0.186 | −0.558 | −0.650 | −0.316 |
| 2PHL | −0.094 | −0.731 | −0.241 | −0.224 | −0.727 | −0.428 |
| 5DME | 0.601 | −0.236 | 0.585 | −0.295 | −0.605 | 0.543 |
| 1PHL | 0.689 | −0.476 | 0.293 | −0.299 | −0.255 | 0.082 |
| 2PHL | 0.892 | −0.215 | −0.198 | −0.009 | −0.503 | 0.464 |
| TVER | 0.016 | −0.684 | −0.584 | −0.051 | −0.693 | 0.120 |
| EARS | −0.453 | 0.828 | 0.016 | 0.152 | 0.925 | 0.234 |
| TIBI | 0.477 | −0.282 | −0.626 | 0.004 | −0.350 | 0.230 |
| WBSP | 0.398 | −0.702 | −0.024 | −0.321 | −0.714 | −0.219 |
| LBSP | −0.850 | 0.386 | −0.005 | 0.756 | 0.450 | 0.459 |
| CIMA | −0.905 | 0.187 | −0.194 | 0.882 | 0.249 | −0.350 |
| GRLG | −0.921 | 0.144 | −0.173 | 0.948 | 0.193 | −0.199 |
| $C\text{-}M_3$ | −0.813 | −0.079 | −0.160 | 0.791 | −0.025 | −0.563 |
| $C_1\text{-}C_1$ | −0.884 | −0.172 | −0.210 | 0.709 | −0.348 | −0.528 |
| TOLG | −0.979 | −0.097 | −0.095 | 0.991 | 0.031 | −0.017 |
| CBLG | −0.986 | 0.052 | −0.063 | 0.963 | 0.206 | 0.052 |
| PALA | −0.923 | 0.016 | −0.221 | 0.935 | 0.090 | −0.258 |
| ZYGO | −0.923 | −0.316 | 0.142 | 0.957 | −0.243 | 0.067 |
| MAST | −0.803 | −0.368 | 0.410 | 0.827 | −0.351 | 0.367 |
| LACH | −0.846 | −0.351 | 0.310 | 0.904 | −0.310 | 0.043 |
| IOWI | −0.890 | −0.359 | 0.164 | 0.907 | −0.347 | −0.060 |
| HBCA | −0.622 | −0.691 | 0.003 | 0.666 | −0.688 | 0.160 |
| $M^3\text{-}M^3$ | −0.888 | −0.412 | 0.080 | 0.895 | −0.353 | 0.250 |
| $C\text{-}M^3$ | −0.960 | −0.051 | −0.064 | 0.953 | 0.099 | −0.211 |
| $C^1\text{-}C^1$ | −0.821 | −0.073 | 0.026 | 0.665 | 0.150 | −0.576 |
| POCO | −0.695 | −0.532 | 0.355 | 0.723 | −0.476 | 0.469 |
| BBC 2 | −0.756 | −0.369 | 0.475 | 0.819 | −0.315 | 0.421 |
| Percent Variance Explained | 57.93 | 16.44 | 10.14 | 45.40 | 24.15 | 11.67 |

*perotis*, *E. p. californicus*, *E. trumbulli*, and *E. dabbenei*. The cophenetic correlations (0.74 and 0.75, respectively) indicate a poor fit of the phenograms to the similarity matrices. The clusters formed in the distance/forearm phenograms (Fig. 6) differ from the previous phenograms. OTUs *E. glaucinus* and *E. g. floridanus*; *E. auripendulus* and *E. underwoodi*; *E. p. perotis*, *E. p. californicus*, and *E. trumbulli* form three main clusters. The cophenetic correlations are 0.98 for males and 0.94 for females and represent a very good fit of the phenograms to the matrices. The coefficient of correlation of cophenetic values for the distance phenograms is 0.47 for males and 0.19 for females, indicating little similarity between the two methods.

Results of cluster analysis of correlation coefficients (Fig. 7) are similar to those produced by distance/forearm, but the cophenetic correlations are lower

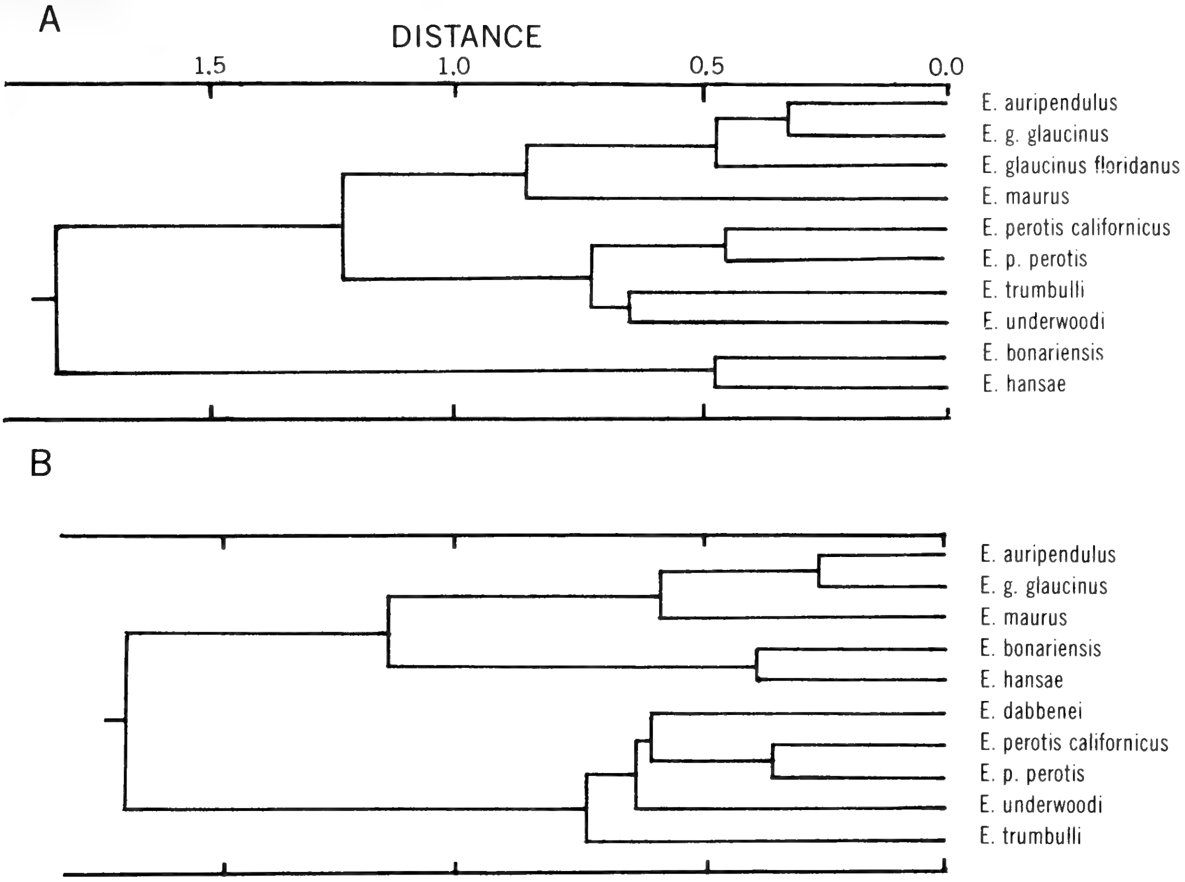


Fig. 5. Phenograms of average taxonomic distance.
A. Male *Eumops*; cophenetic correlation is 0.74
B. Female *Eumops*; cophenetic correlation is 0.75

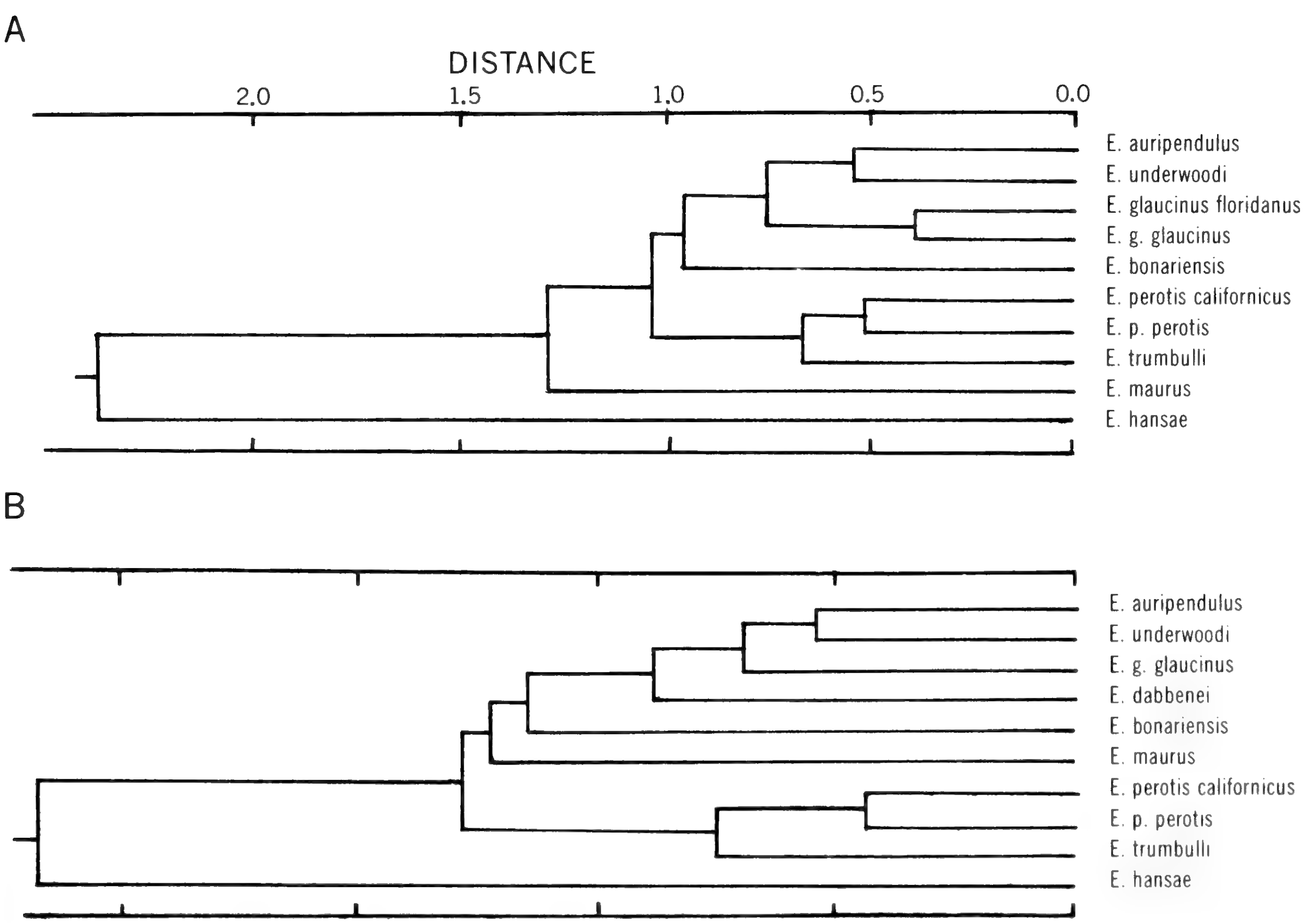


Fig. 6. Phenograms of average taxonomic distance based on characters divided by forearm length.
A. Male *Eumops*; cophenetic correlation is 0.98
B. Female *Eumops*; cophenetic correlation is 0.94

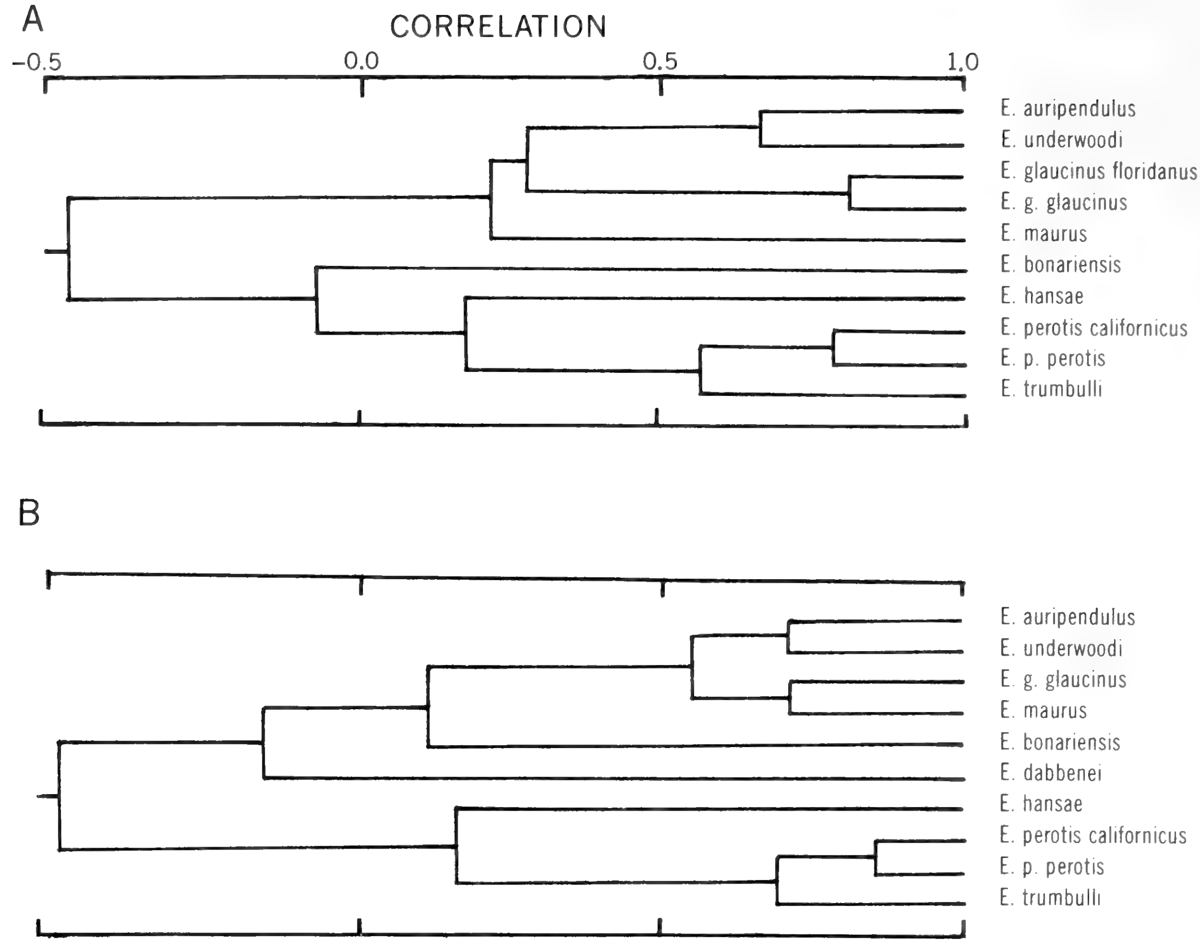


Fig. 7. Phenograms of correlation coefficients.
A. Male *Eumops*; cophenetic correlation is 0.89
B. Female *Eumops*; cophenetic correlation is 0.89

(males, 0.89; females, 0.89), indicating more distortion in the correlation phenograms. The coefficients of correlation of cophenetic values comparing these two correlation methods are 0.79 (males) and 0.81 (females), indicating a reasonable similarity.

The correlation/forearm phenograms (Fig. 8) are similar to the original correlation phenograms. The cophenetic correlation for males indicates the same fit of phenogram to similarity matrix (0.89) but for females the fit is not as good (0.81).

The effect of removing principal component I (presumably a size factor) from the distance matrix is illustrated in Fig. 9. The two main clusters formed differ considerably from those produced in the other analyses. The cophenetic correlations (male, 0.81; female, 0.83) indicate that the phenograms represent the similarity matrices reasonably well.

**Geographic Variation in *Eumops auripendulus***

I divided specimens of female *Eumops auripendulus* into 10 locality samples (Table 4). Multivariate analysis of variance indicated that significant differences exist among localities ($F$ transformation of Wilks' lambda = 2.86, d.f. = 315 and 1271, $P < 0.001$). In the generalized discriminant functions analysis,

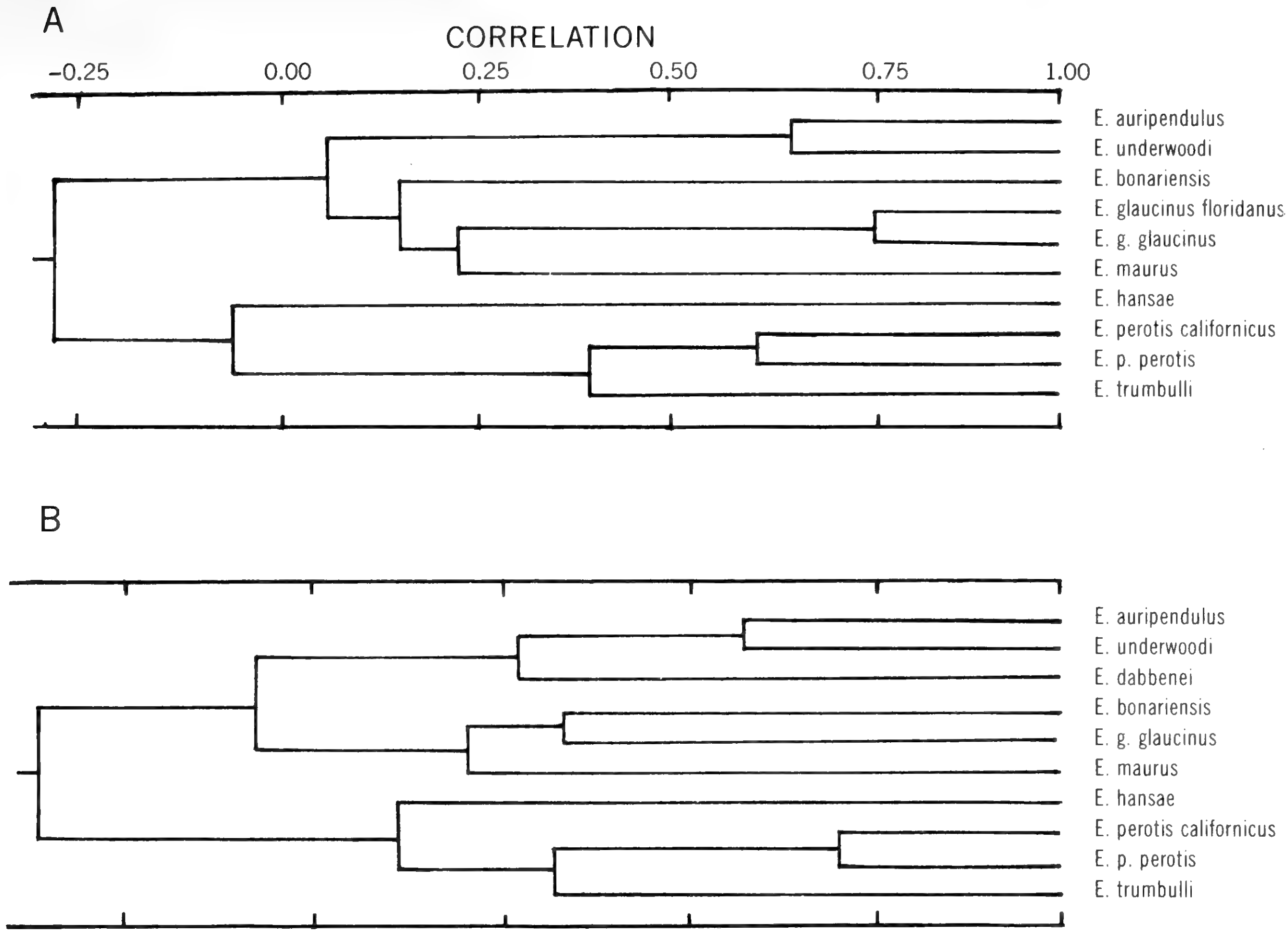


Fig. 8. Phenograms of correlation coefficients divided by forearm length.
A. Male *Eumops*; cophenetic correlation is 0.89
B. Female *Eumops*; cophenetic correlation is 0.81

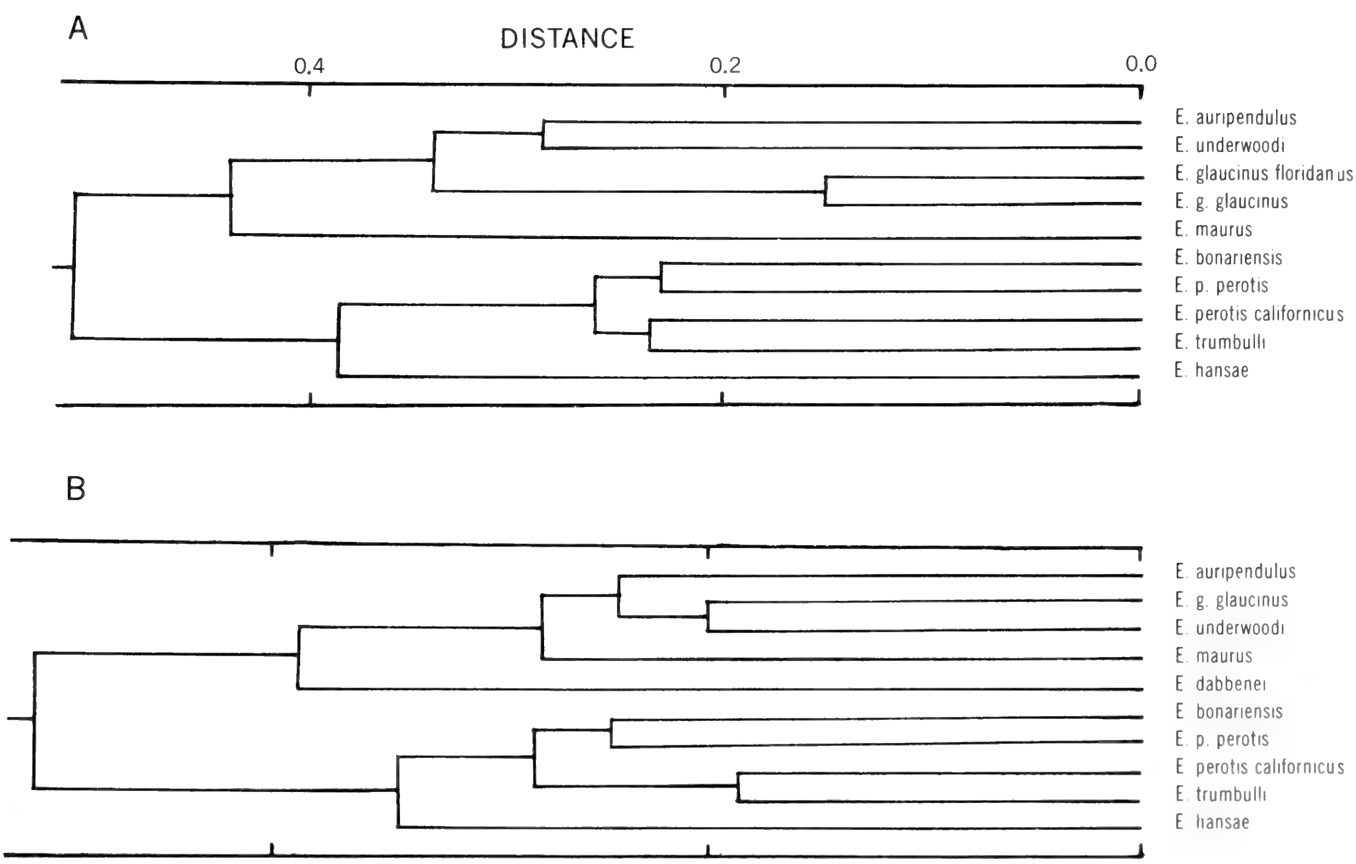


Fig. 9. Phenograms derived from distance matrices with the effect of principal component I removed.
A. Male *Eumops*; cophenetic correlation is 0.81
B. Female *Eumops*; cophenetic correlation is 0.83

**Table 4. Specimens used to analyze geographic variation in female *Eumops auripendulus***

| Sample | Distribution and Number |
|---|---|
| 1. Honduras (HOND)<br>n = 7 | Copán (7) |
| 2. Costa Rica (COST)<br>n = 52 | Cariblanca (26), Turrialba (26) |
| 3. Panama, western Colombia, and Ecuador (PANA)<br>n = 36 | Panama, all localities (21, see Systematic Section); Colombia: Mompós (2), Don Diego (6), Barbacoas (5); Ecuador: Balzar (1), Río Mongoya (1) |
| 4. Eastern Colombia (COLE)<br>n = 10 | Guicaramo (3), Villavicencio (7) |
| 5. Northern Venezuela (VENZ)<br>n = 8 | Río Yaracuy (4), Parapara (1), San Fernando de Atabapo (2), Lagunillas (1) |
| 6. Guyana, French Guiana, Surinam and southern Venezuela (GUYA)<br>n = 34 | Guyana: Kanashen (1), Arakaka (18); French Guiana: Cayenne (2); Surinam: Slootwijk (1), Paramaribo (1), Alalapadoo (4); Venezuela: El Dorado (7) |
| 7. Peru (PERU)<br>n = 12 | Peru: Hacienda San Antonio (2), Tingo María (1), Vista Alegre (1), Perené (4), Guayabamba (4) |
| 8. Acre (ACRE)<br>n = 10 | Brazil: Acre (10) |
| 9. Argentina, southern and eastern Brazil (ARGT)<br>n = 10 | Argentina (3); Brazil: Baturité (1), Quixadá (1), Santa Teresa (1), Iporanga (1), Itapetininga (1), Jaquia (1), São Paulo (1) |
| 10. Brazil (AMAZ)<br>n = 8 | Lake Tefé (3), Faro (5) |

the first five eigenvalues explain statistically significant amounts of variation among localities and accounted for 88.66 per cent of the variation. Three discriminant axes account for 76.56 per cent and therefore provide a reasonable dimensionality in which interlocality similarities could be assessed.

The discriminant diagrams for *E. auripendulus* (Fig. 10 and 11) demonstrate that phenetic relationships among localities approximate what would be expected from the geographic position of localities, i.e., three major groups. The most northern localities, Honduras and Costa Rica, are isolated from a second group consisting of Panama and northern South America and a third of southern and eastern Brazil and Argentina. In the second group, Guyana, Peru, and Panama are separate from Acre, Brazil. Discriminant function I is a size axis and explains the greatest amount of interlocality variation. Along this axis there is a north-south cline of increasing size among populations, although Acre is an exception to this trend. There is a clear separation of Acre and Argentina from all other localities on discriminant functions I and III (Fig. 11).

Inspection of character vectors indicates that populations of *E. auripendulus* from Brazil and Argentina differ from the remaining populations by larger condylobasal and condyloincisive lengths, and smaller zygomatic width. Bats

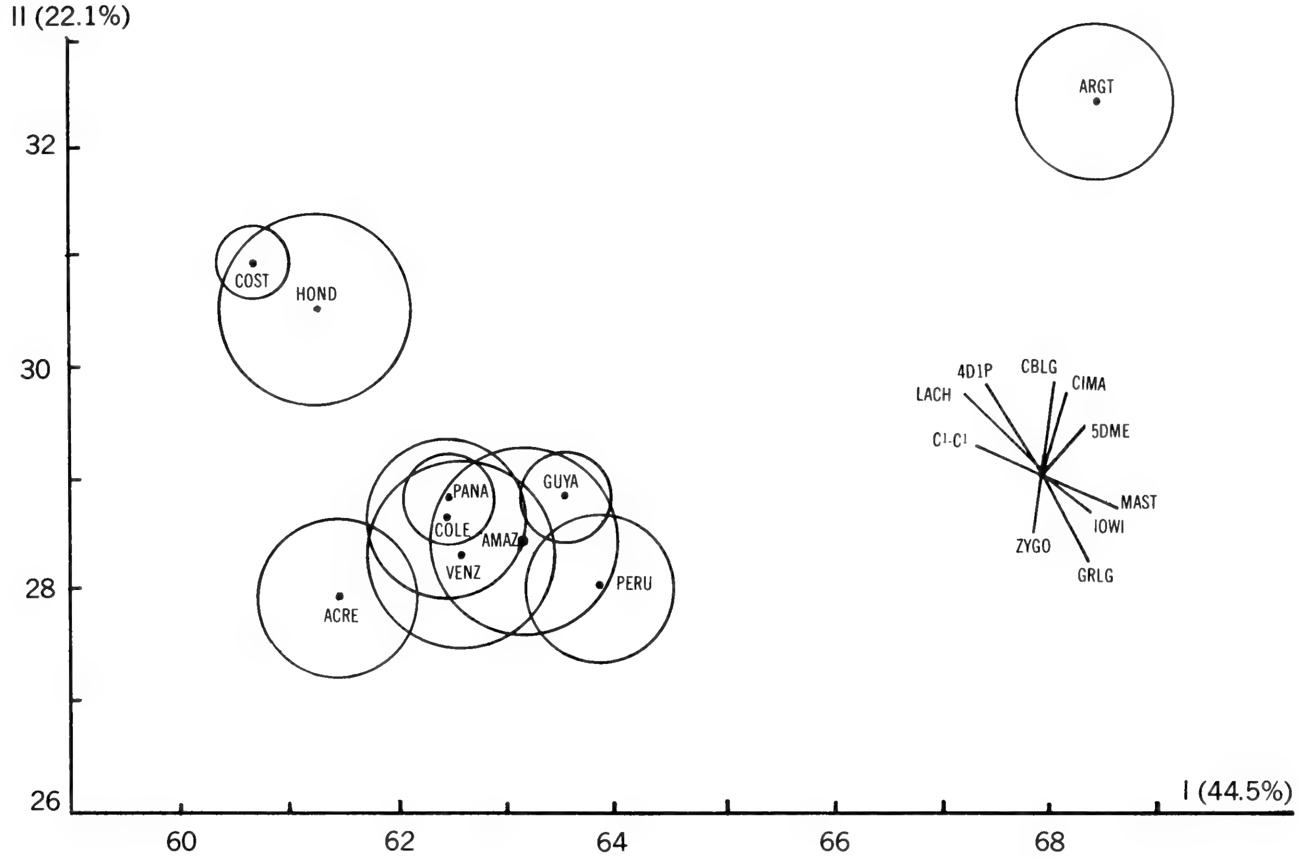


Fig. 10. Discriminant functions I and II of female *E. auripendulus*. See Table 4 for explanation of abbreviations.

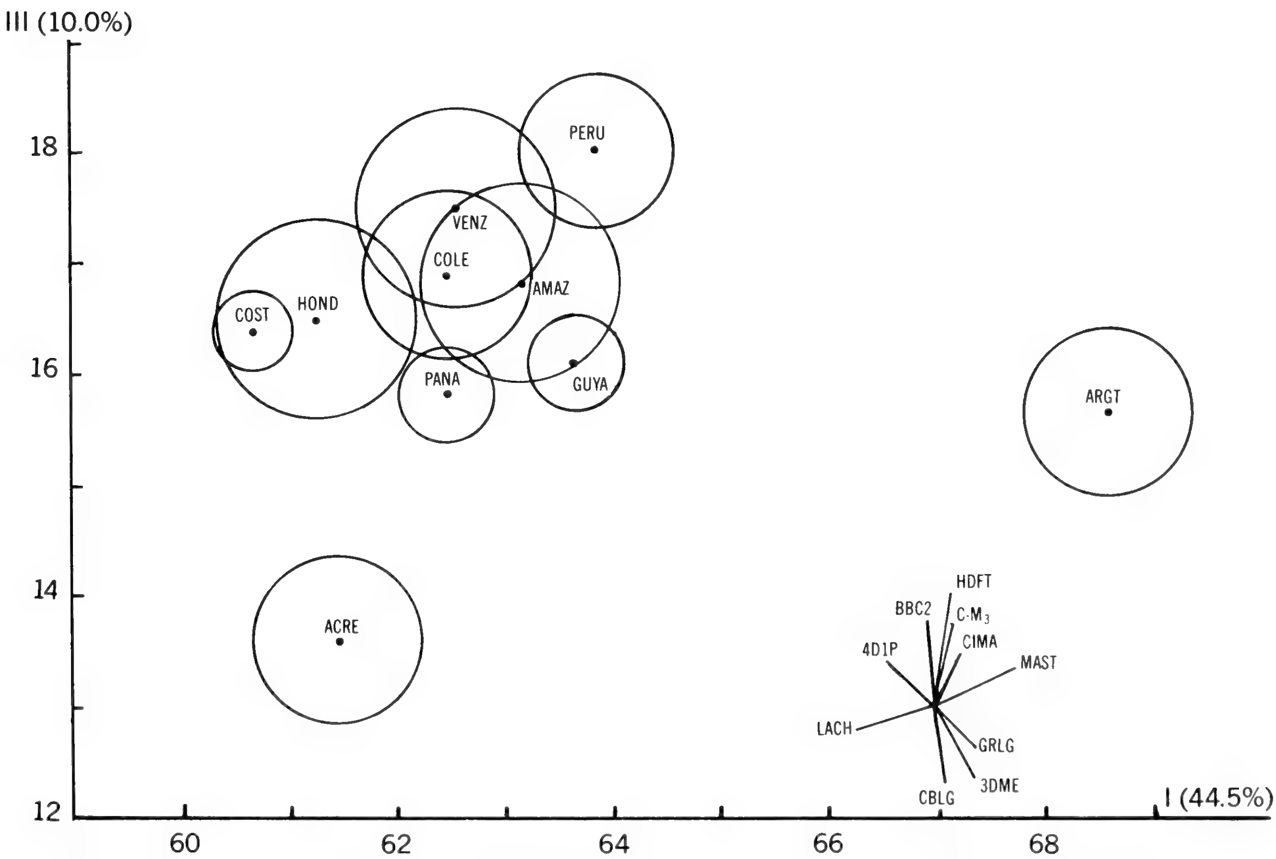


Fig. 11. Discriminant functions I and III of female *E. auripendulus*. See Table 4 for explanation of abbreviations.

from Costa Rica and Honduras differ from the remaining populations (except Argentina) on the basis of wider lacrimal width, width across canines, and longer fourth digit first phalanx, with shorter skull length. There is phenetic separation on the third axis among localities that overlap on the first and second axes. Acre differs from all other localities by smaller hindfoot and condylobasal length and a narrower braincase. A broader mastoid width distinguished Argentina from all other geographic entities.

### Geographic Variation in *Eumops glaucinus*

Female *Eumops g. glaucinus* were divided into nine locality samples (Table 5). Multivariate analysis of variance indicates that significant differences exist among localities ($F$ transformation of Wilks' lambda = 4.09, d.f. = 296 and 746, $P < 0.001$). In the discriminant functions analysis the first six eigenvalues explain statistically significant amounts of variation among localities and account for 95.8 per cent of variation. For illustrative purposes, only the first three axes were used, collectively accounting for 79.96 per cent of the total variation (Fig. 12 and 13). The projection of locality centroids on the first and second axes produced three discrete groups. The most northerly consists of northern and southern Mexico and Costa Rica, the second consists of Cuba, Guyana, northern Colombia, and Peru, and the third of northern Venezuela and eastern Colombia. Inspection of character vectors indicates that populations of

**Table 5. Specimens used to analyze geographic variation in female *Eumops glaucinus***

| Sample | Distribution and Number |
|---|---|
| 1. Northern Mexico (MEXN) n = 12 | Pueblo Juárez area (8), La Jala (2), La Sidra (1), Río Armería (1) |
| 2. Southern Mexico (MEXS) n = 14 | Ortiz Rubio (2), Rancho San Fernando (3), Tonalá (5), Cintalapa (1), Jesús Carranza (3) |
| 3. Costa Rica (COST) n = 16 | Cariblanca (1), Santa Ana (15) |
| 4. Northern Colombia (COLN) n = 14 | Sincelejo (7), Santa Marta (4), Espinal (1), Honda (2) |
| 5. Eastern Colombia and western Venezuela (COLL) n = 34 | Colombia: El Yopal (2), Puerto López (4); Venezuela: San Juan (28) |
| 6. Northern Venezuela (VENZ) n = 12 | Montalbán (2), Río Tocuyo (3), San Felipe (6), Zulia (1) |
| 7. Guyana (GUYA) n = 12 | Aroquoi tributary (7), Achamere Wau (5) |
| 8. Peru (PERU) n = 8 | Peru: Suyo (8) |
| 9. Cuba (CUBA) n = 16 | All localities. See Systematic Section |

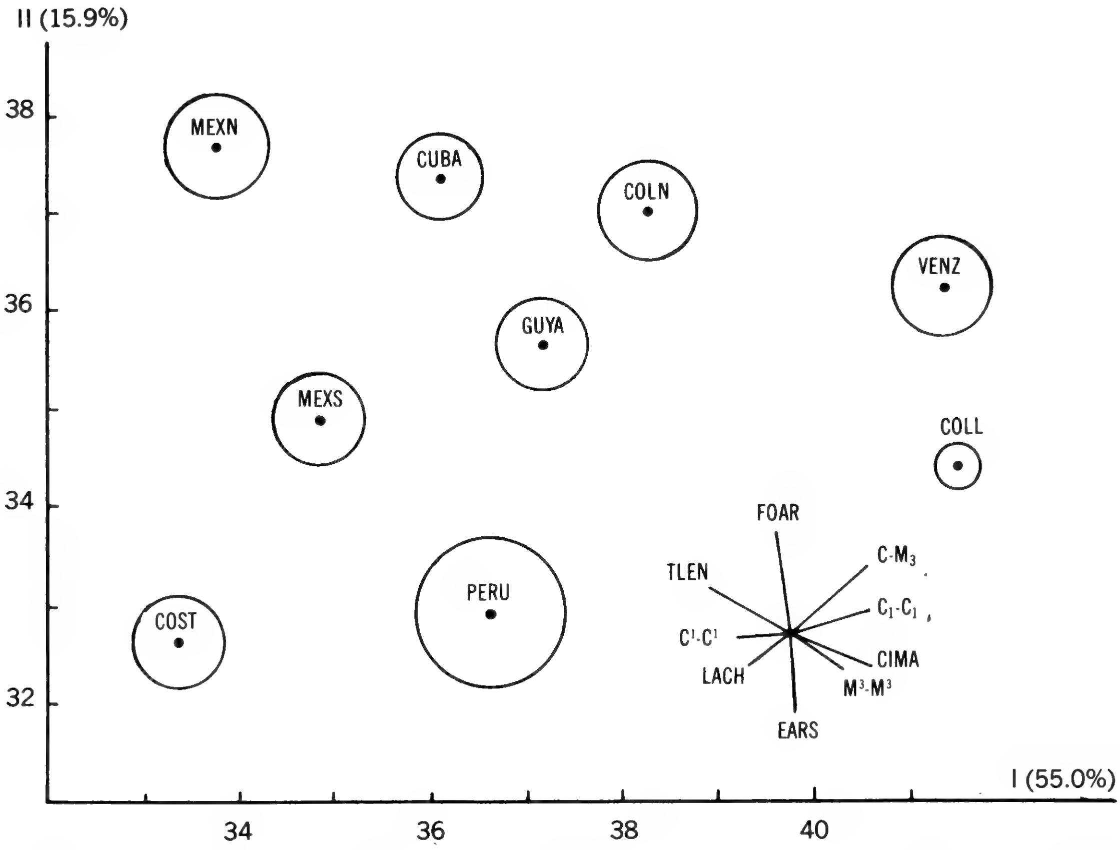


Fig. 12. Discriminant functions I and II of female *E. glaucinus*. See Table 5 for explanation of abbreviations.

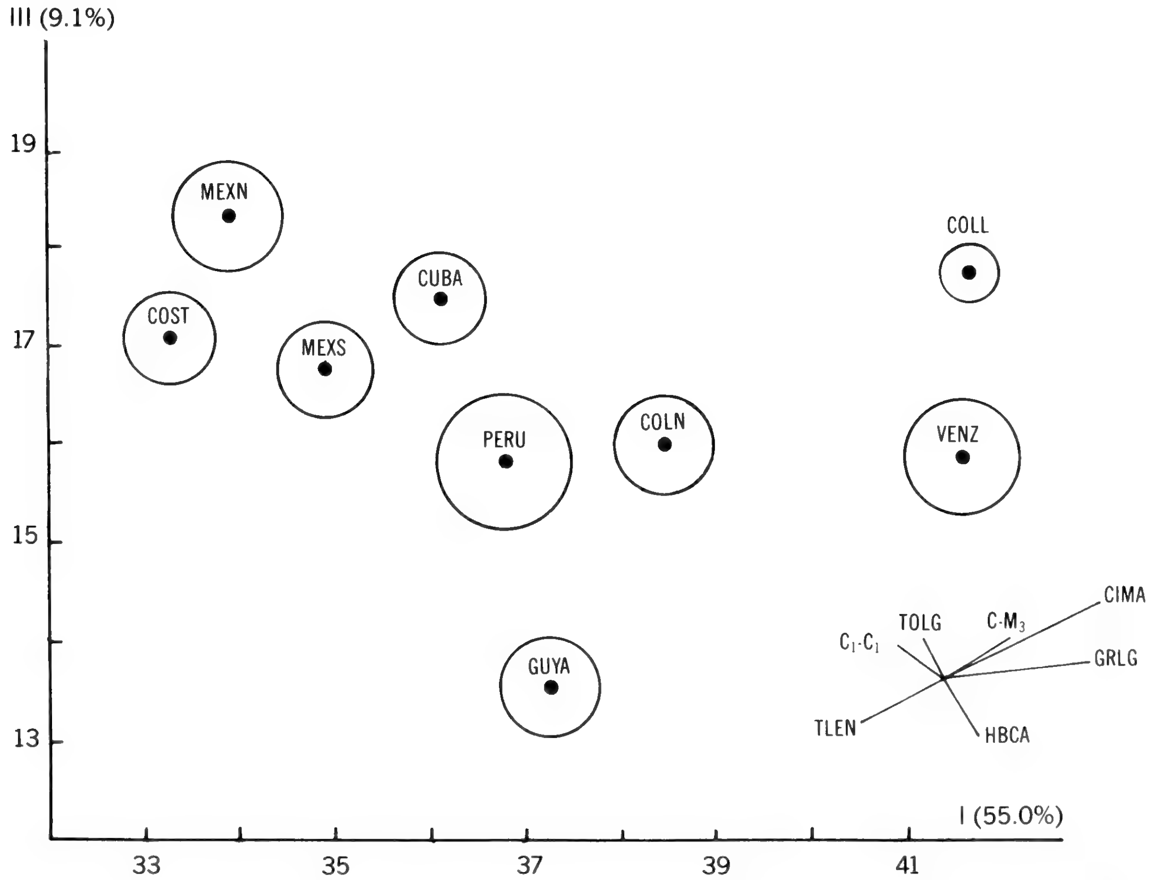


Fig. 13. Discriminant functions I and III of female *E. glaucinus*. See Table 5 for explanation of abbreviations.

*E. glaucinus* from Venezuela and Colombia are larger than the remaining populations in mandible length and width, whereas northern Mexico, Cuba, and northern Colombia are larger in forearm and body lengths.

The northernmost localities (Mexico north and south, Costa Rica, and Cuba) are separate from other localities on discriminant functions I and III (Fig. 13). Peru and Colombia form a second group. Character vectors indicate that bats from Mexico, Costa Rica, and Cuba have long skull lengths and wide canine-canine widths and narrower braincases. Long mandibles characterize populations from Colombia and Venezuela.

Specimens of male *E. glaucinus* were divided into eight locality samples (Table 6). In results of SS-STP analyses of five characters (Fig. 14), *E. glaucinus floridanus* is always significantly different from all other localities. In four of five characters, the samples from Colombia, Venezuela, and Cuba are combined in non-significant subsets. The samples from Costa Rica and Honduras are in the same non-significant subset, with the exception of forearm length.

**Table 6. Specimens used in SS-STP analyses of geographic variation in male *Eumops glaucinus***

| Sample | Distribution and Number |
|---|---|
| 1. Florida (FLOR) n = 21 | Miami (21) |
| 2. Colombia (COLM) n = 6 | Sincelejo (2), Puerto Salgar (1), Honda (3) |
| 3. Venezuela, eastern Colombia and Guyana (VENZ) n = 27 | Venezuela: San Jaun (10), Maripa (1), Caracas (1), Chichiriviche (1), Río Tocuyo (1), Cumaná (1), San Felipe (3); Colombia: Puerto López (3), Restrepo (2); Guyana: Aroquoi tributary (1), Achamere Wau (1), Rewa River (2) |
| 4. Peru and Ecuador (PERU) n = 8 | Perú: Suyo (6); Ecuador: Guayaquil (2) |
| 5. Mexico (MEXI) n = 6 | Palenque (1), Rancho San Fernando (1), Las Juntas (2), Pueblo Juárez (1) |
| 6. Costa Rica (COST) n = 8 | Cariblanca (1), Turrialba (1), Santa Ana (6) |
| 7. Honduras and Nicaragua (HOND) n = 5 | Honduras: Comayagua (2), La Paz (2); Nicaragua: Yalaquina (1) |
| 8. Cuba (CUBA) n = 16 | All localities. See Systematic Section. |

| | $\bar{X}$ | |
|---|---|---|
| FLOR | 64.27 | I |
| HOND | 60.82 | I |
| CUBA | 60.56 | I |
| COLM | 60.31 | II |
| MEXI | 60.11 | II |
| VENZ | 59.12 | I |
| COST | 58.82 | I |
| PERU | 58.72 | I |

A

| | $\bar{X}$ | |
|---|---|---|
| FLOR | 18.53 | I |
| VENZ | 17.32 | I |
| COLM | 17.16 | II |
| CUBA | 16.97 | II |
| PERU | 16.96 | III |
| MEXI | 16.62 | II |
| HOND | 16.39 | II |
| COST | 16.31 | I |

B

| | $\bar{X}$ | |
|---|---|---|
| FLOR | 25.52 | I |
| COLM | 23.96 | I |
| VENZ | 23.87 | I |
| CUBA | 23.41 | II |
| PERU | 23.35 | II |
| MEXI | 23.35 | I |
| HOND | 23.12 | I |
| COST | 22.91 | I |

C

| | $\bar{X}$ | |
|---|---|---|
| FLOR | 16.40 | I |
| VENZ | 14.93 | I |
| COLM | 14.69 | II |
| MEXI | 14.67 | III |
| CUBA | 14.62 | IIII |
| COST | 14.17 | III |
| HOND | 14.15 | II |
| PERU | 14.13 | I |

D

| | $\bar{X}$ | |
|---|---|---|
| FLOR | 10.88 | I |
| VENZ | 10.41 | I |
| COLM | 10.23 | II |
| CUBA | 10.04 | III |
| MEXI | 9.95 | III |
| PERU | 9.82 | III |
| COST | 9.62 | II |
| HOND | 9.58 | I |

E

Fig. 14. Results of five SS-STP analyses (A. forearm length, B. condyloincisive length, C. condylobasal length, D. zygomatic width, and E. width across third molars) of geographic variation of male *Eumops glaucinus*. Vertical line to the right of each array of means connect maximally non-significant subsets at the 0.05 level. See Table 6 for explanation of abbreviations.

## *Discussion*

The R-mode principal component analysis is useful to illustrate affinities because it does not assume hierarchical relationships among OTUs. The results of the PCA closely compare with the distance phenograms, illustrating size relationships of the OTUs. The results of PCA of characters/forearm are complementary to the distance/forearm and correlation phenograms, and the minimum spanning tree clarifies the positions of *E. maurus*, *E. bonariensis*, and *E. dabbenei*.

Five Q-mode clustering techniques were used to provide multiple phenetic classifications. Because the complements of OTUs studied differ for males and females, results might be expected to differ for the sexes. The addition or removal of an OTU from a Q-mode similarity matrix causes differences in the composition of the matrix and therefore accounts for discrepancies between phenograms of males and females. The clusters from the distance matrices are based largely on size. For example, *E. glaucinus* and *E. auripendulus* (two species of similar size) cluster together, but are distinct species on other criteria. When the distance matrices are divided by forearm, OTUs of similar shape and size cluster together. Conversely, the phenogram produced from the correlation matrix based on characters/forearm is similar to the correlation phenogram based on raw characters, and both phenograms have clusters similar in composition to the distance/forearm. The latter has a much higher cophenetic correlation and consequently best represents phenetic relationships within the genus. Removing principal component I from the distance matrix not only eliminates size but may also remove any shape related to size, and the resulting phenogram is different. Similarly, Robins and Schnell (1971) found that where size was unchecked or eliminated, phenograms were more divergent than those obtained from other methods.

Sokal and Michener (1967), Schnell (1970), and Robins and Schnell (1971) found that correlations tend to give more uniform results than distances when differently treated sets of data are analyzed for the same OTUs. But because of the minimum distortion given by the distance/forearm phenograms in this study, these phenograms best represent the phenetic relationships in the genus.

### Geographic Variation

#### *Eumops auripendulus*

The discriminant functions analysis demonstrates that phenetic relationships among localities approximate what would be expected from the relative geographic position of localities. Samples from Costa Rica and Honduras are homogeneous, as are samples from Panama and northern South America. The sample from Argentina represents a phenetically distinct group within the species. Specimens of *E. auripendulus* from eastern Brazil and Argentina were compared with *E. auripendulus* from the adjacent Amazon region of Brazil and were found to be statistically significantly different in 31 of 38 characters (Eger, 1974). Conversely, population differences between Central and northern South American populations are clinal and appear to lack discontinuities.

A lowland forest occurs from the Isthmus of Tehuantepec southeast across the Yucatan Peninsula through Central America to South America and continues southward to the Pacific lowlands of Colombia to northern Ecuador (Haffer, 1969). Samples from Peru and the Amazon region of Brazil are phenetically similar, probably because there is no barrier to gene exchange, for Peruvian specimens distributed east of the Andes are situated in a region that is part of the Amazon basin. *E. a. auripendulus* is therefore confined to lowland rain forest except in Peru, where it occurs in upland rain forest. *E. a. major* occurs in an area of upland semideciduous forest, which is isolated by a large savanna and scrub forest from the Amazonian rain forest. The presence of this upland semideciduous forest could account for the isolation of the eastern population. Or perhaps, as Haffer (1969) suggested, the forest refugia in central South America were instrumental in this isolation.

***Eumops glaucinus***

The discriminant functions analysis demonstrates that populations of *E. glaucinus* are isolated from each other, as 95 per cent confidence circles indicate significantly different populations. The northern Mexican population is isolated from the southern Mexican population by the Sierra Madre del Sur. Because *E. g. glaucinus* occurs in the Greater Antilles but not in the Lesser Antilles, I assume that populations on Cuba and Jamaica were derived from Central rather than from South America. The position of Cuban bats in a cluster with Mexican bats suggests that Cuban populations may have been derived from Mexican *E. glaucinus*. During the Tertiary and Quaternary, climatic and geologic events probably affected dispersion of this bat. Fluctuations in sea level caused a restriction or expansion of landmass, and the latter would have resulted in a narrower gap between Cuba and the Yucatan Peninsula and also between Jamaica and the Honduran-Nicaraguan region (Darlington, 1957). A more recent explanation for the distribution of *E. glaucinus* comes from Rosen (1975), who suggested that as there is no evidence of a close relationship between the Antilles and Florida populations, a vicariant event causing the subdivision of the species range could have occurred in the Gulf coastal region of North America and Mexico.

The Florida population of *E. glaucinus floridanus* is isolated from *E. g. glaucinus* and has probably been isolated for considerable time. The single known fossil specimen of *E. g. floridanus* is probably Pleistocene in age and is indistinguishable from present Florida representatives (Koopman, 1971).

Results of SS-STP do not indicate any apparent north-south cline but rather two subsets – Peru, Costa Rica, and Honduras as one group and Colombia, Venezuela, and Cuba as another. Warner *et al.* (1974) described three karyotypes for *E. glaucinus*. Specimens from Puerto Lopez, Colombia, possessed a diploid number of 40, whereas those from Mexico, Honduras, and Costa Rica had a diploid number of 38. They also demonstrated dimorphism in a pair of chromosomes about the size of the X-chromosome of *E. g. glaucinus* but were unable to determine if races were involved, or if it was widely distributed polymorphism as was found in *Mimon* (Baker *et al.*, 1972b). Statistical analyses indicate that *E. glaucinus* is a polytypic species consisting of several isolated populations.

# *Systematic Section*

## *Eumops* Miller, 1906

*Vespertilio* Shaw, 1800: 137 (non *Vespertilio* Linnaeus, 1758).
*Molossus* Schinz, 1821: 870 (non *Molossus* Geoffroy, 1805).
*Dysopes* Wied, 1826: 226 (non *Dysopes* Illiger, 1811).
*Promops* Peters, 1874: 232 (non *Promops* Gervais, 1855).

**Type Species**
*Molossus californicus* Merriam, 1890.

**Distribution**
Generally below 3,000 metres, throughout the Americas from southern regions of California, Arizona, Texas, and Florida, south through Middle America to central Argentina; and Cuba, Jamaica, and Trinidad.

**Diagnosis**
Bats of this genus differ greatly in size, with lengths of forearms ranging from 37 in *Eumops bonariensis* to 83 in *E. perotis*. Externally distinguished from other genera in the family Molossidae by large rounded pinnae joined medially on the forehead; tragus reduced, square or pointed; antitragus large, semiovate; ear keel greatly developed; smooth upper lips; skull cylindrical with well-developed basisphenoid pits; a single pair of curved upper incisors; palate slightly arched. Dental formula is $^1/_2$, $^1/_1$, $^2/_2$, $^3/_3$, but occasionally first upper premolars are reduced to $^1/_2$; molars with typical w-pattern; $M^3$ with third commissure variable in development.

## *Eumops auripendulus* (Shaw, 1800)

*Vespertilio auripendulus* Shaw, 1800: 137 (non *Vespertilio* Linnaeus, 1758).
*Molossus rufus* Geoffroy, 1805: 155 (non *Molossus* Geoffroy, 1805: 151).
*Molossus amplexi-caudatus* Geoffroy, 1805: 156 (non *Molossus* Geoffroy, 1805: 151).
*Dysopes longimanus* Wagner, 1843: 367 (non *Dysopes* Illiger, 1811).
*Dysopes leucopleura* Wagner, 1843: 367 (non *Dysopes* Illiger, 1811).
*Molossus nasutus* J. A. Allen, 1897: 115 (non *Molossus nasutus* Spix, 1823).
*Promops milleri* J. A. Allen, 1900: 92 (non *Promops* Gervais, 1855).
*Promops barbatus* J. A. Allen, 1904: 228 (non *Promops* Gervais, 1855).
*Eumops abrasus* Miller, 1906: 85 (non *Dysopes abrasus* Temminck, 1827).
*Eumops milleri* Miller, 1906: 85.
*Eumops maurus* Villa R., 1956: 543 (non *Molossus maurus* Thomas, 1901).
*Eumops auripendulus* Goodwin, 1960: 5.

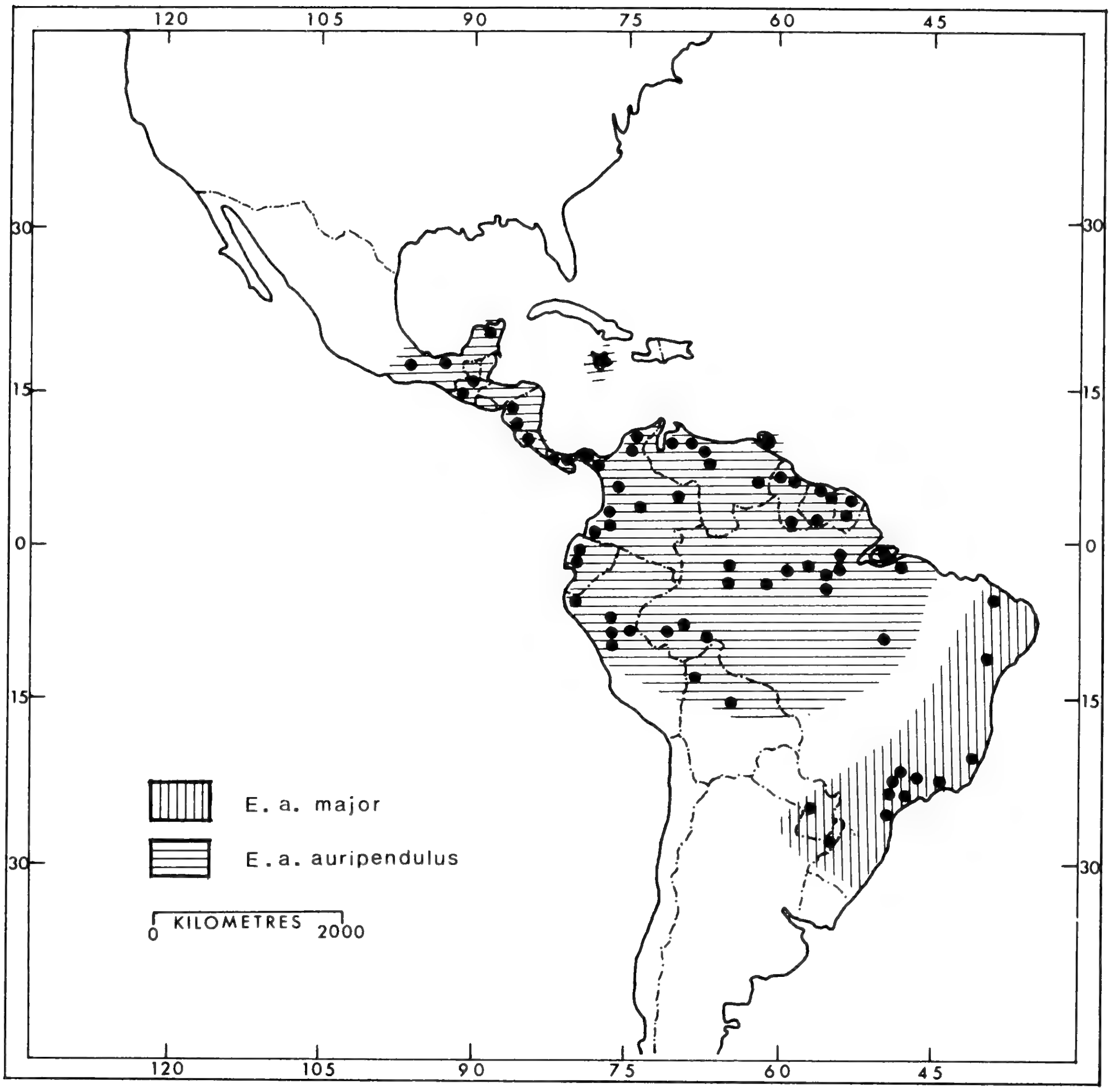


Fig. 15. Distribution of *Eumops auripendulus*. See Systematic Section for list of localities.

**Distribution**

Southern Mexico south to northern Argentina (Fig. 15).

**Diagnosis**

Size, medium; forearm length, 55 to 68; colour, Blackish Brown to dark Chestnut-Brown; third commissure of $M^3$ rudimentary.

**Differential Diagnosis**

Similar in size to *Eumops glaucinus* but differs by dark colour; pointed tragus; smaller, more shallow basisphenoid pits; skull shorter, less robust, with proportionally narrower widths of mastoid and postorbital constriction.

## *Eumops auripendulus auripendulus* (Shaw, 1800)

*Eumops abrasus milleri* Sanborn, 1932: 352.
*Eumops abrasus oaxacensis* Goodwin, 1956: 2.
*Eumops a. auripendulus* Husson, 1962: 240.
*Eumops auripendulus oaxacensis* Goodwin, 1969: 112.
*Eumops auripendulus oaxacensis* Jones *et al.*, 1973: 26.

### Holotype

No holotype originally designated. First named the slouch-eared bat by Pennant (1793) from a description and drawing given by Buffon (1789). Subsequently Shaw (1800) renamed this species *Vespertilio auripendulus*. Goodwin (1960) clarified the status of *E. auripendulus*, and Husson (1962) restricted the type locality to French Guiana.

### Distribution

Southern Mexico south to Bolivia and the Amazon region of Brazil; and Jamaica and Trinidad (Fig. 15).

### Diagnosis

See Fig. 16 and Table 7. Tragus small and pointed, about 2 mm long; dorsal fur Blackish Brown to dark Chestnut-Brown, paler basal band; ventral pelage paler; basisphenoid pits moderately well developed, shallow.

### Differential Diagnosis

Smaller than *Eumops auripendulus major*, distinguished by shorter forearm and condylobasal lengths.

### Specimens Examined and Distribution Records

BOLIVIA. Beni: Camiaco, 16 km N Limoquique (=Limoquije) 15°15′S 64°46′W, 1 (AMNH). La Paz: Ixiamas, 13°45′S 68°10′W, 1 (USNM). BRAZIL. No locality, 29 (MCZ). Lake Hyanuary, 1 (MCZ). Acre: Plácido de Castro, 10°20′S 67°11′W, 10 (USP); Tarauacá, 8°10′S 70°46′W, 1 (USP). Amazonas: Lagoa

**Table 7. Selected sample statistics of *Eumops a. auripendulus***

| | Male | | | Female | | |
|---|---|---|---|---|---|---|
| Character | n | $\overline{X}$ | ±S.E. | n | $\overline{X}$ | ±S.E. |
| FOAR | 74 | 58.64 | 0.15 | 214 | 58.34 | 0.09 |
| TOLG | 43 | 25.12 | 0.08 | 133 | 24.74 | 0.04 |
| CBLG | 39 | 23.14 | 0.08 | 128 | 22.77 | 0.04 |
| ZYGO | 43 | 14.32 | 0.05 | 140 | 14.11 | 0.03 |
| MAST | 39 | 12.28 | 0.05 | 132 | 12.17 | 0.02 |
| HBCA | 39 | 8.70 | 0.04 | 129 | 8.53 | 0.03 |
| $C\text{-}M^3$ | 47 | 9.51 | 0.03 | 150 | 9.36 | 0.02 |
| POCO | 44 | 4.52 | 0.03 | 143 | 4.50 | 0.01 |

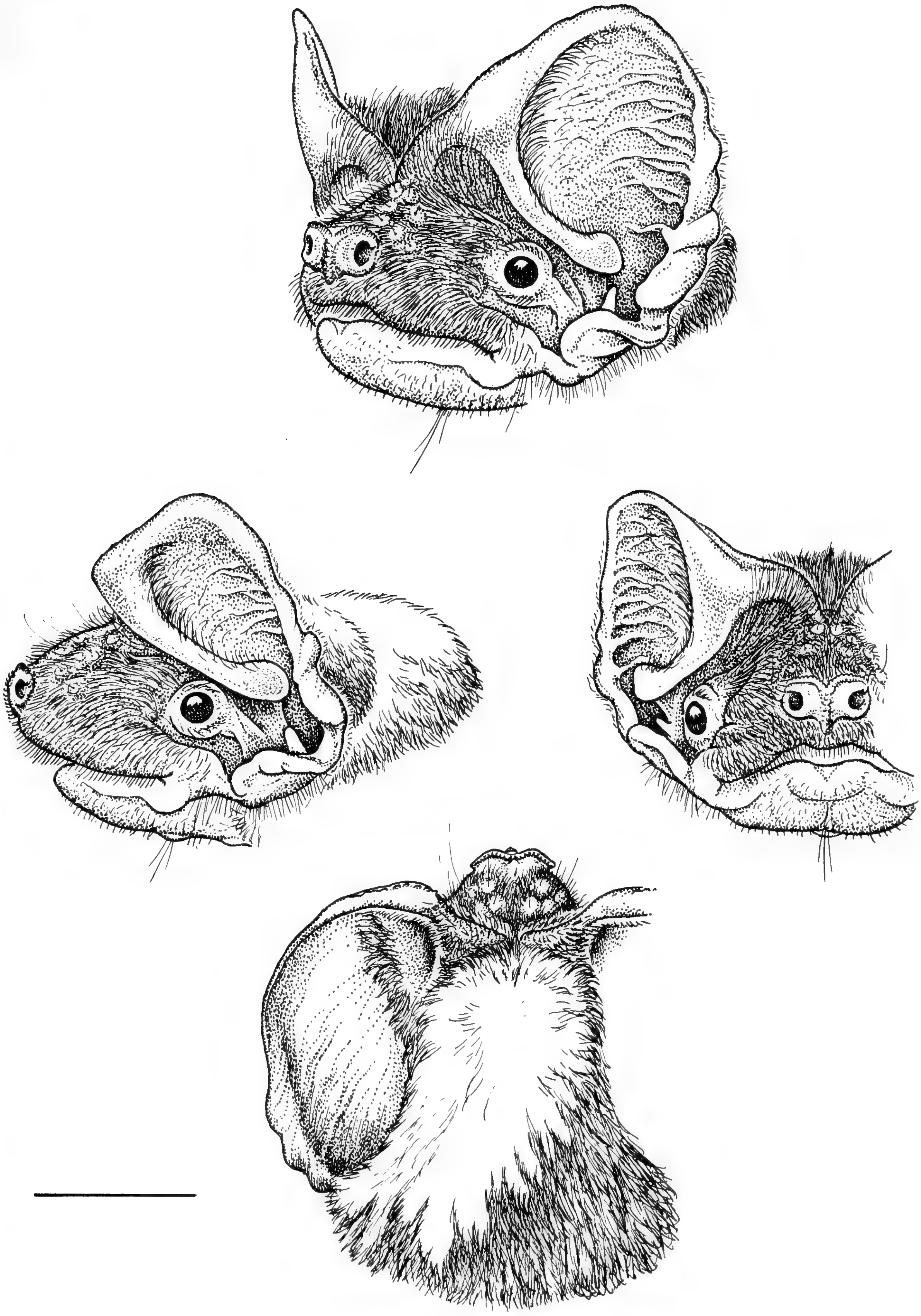

Fig. 16. *Eumops a. auripendulus*. Scale bar = 10 mm.

Anamã, Tacambú, 2°35′S 64°40′W, 1 (BMNH); Xingu, 7°48′S 68°45′W, 3 (LACM); Manacapuru, 3°18′S 60°37′W, 1 (BMNH); mouth of Lake Tefé, 3°27′S 64°47′W, 4 (AMNH). Mato Grosso: São Domingos, Rio das Mortes, 11°45′S 50°44′W, 1 (USP). Pará: Boim near Rio Tapajós, 2°49′S 55°10′W, 2 (USP); Pará (Belém), 1°27′S 48°29′W, 1 (MCZ); Faro, 2°10′S 56°39′W, 7 (AMNH); Rio Tapajós, Limoãl, 2°24′S 54°41′W, 1 (AMNH); Morcêgo, 0°58′S 52°40′W, 1 (USP); Santarém, 2°26′S 54°41′W, 2 (MNHN). BELIZE. Rockstone Pond, 17°46′N 88°22′W, 1 (ROM). COLOMBIA. Antioquia: Medellín, 6°15′N 75°36′W, 1 (BMNH). Bolívar: Mompós, 9°15′N 74°35′W, 2 (USNM). Cauca: Popayán, 2°27′N 76°22′W, 1 (ROM). Magdalena: Don Diego, 11°00′N 73°43′W, 10 (CM). Meta: Guiacaramo, 4°35′N 73°00′W, 4 (MCZ), 1 (AMNH); Villavicencio, 4°09′N 73°38′W, 1 (ROM), 2 (FMNH), 4 (AMNH). Nariño: Barbacoas, 1°38′N 78°08′W, 8 (AMNH). Valle del Cauca: Puerto Merizalde, 3°16′N 77°25′W, 1 (USNM). COSTA RICA. Alajuela: Cariblanca, 18 km NE Naranjo, 9°56′N 84°57′W, 15 (TCWC). Cartago: Turrialba, 9°56′N 83°40′W, 11 (LACM), 2 (KU), 32 (TCWC). Puntarenas: Villa Neily, 10°N 84°50′W, 2 (LACM); San José, 9°59′N 84°04′W, 1 (KU). ECUADOR. Guayas: Balzar, 1°25′S 79°54′W, 1 (MNHN). Manabí: Río Mongoya, 0°10′S 79°38′W, 3 (FMNH). EL SALVADOR. Chilata: Sonsonate, 13°43′N 89°44′W, 1 (MVZ). FRENCH GUIANA. Cayenne, 4°55′N 52°18′W, 2 (MNHN), 1 (USP); Saül, 3°32′N 53°15′W, (Brosset et Dubost, 1967). GUATEMALA. Cobán, 15°28′N 90°21′W, 1 (BMNH). Mazatenango (Finca Cipres), 14°31′N 91°30′W, 1 (AMNH). GUYANA. Demerara: Demerara (Georgetown), 6°46′N 58°10′W, 1 (BMNH). Essequibo: Rupununi, Kanashen, 1°45′N 58°30′W, 1 (ROM). North West District: Arakaka, 7°35′N 60°07′W, 26 (AMNH); Mt. Everard, 3 (AMNH). HONDURAS. Copán: Copán (Ruinas de Copán), 14°52′N 89°10′W, 9 (TCWC). 7 km N Santa Bárbara, 14°56′N 88°11′W, 1 (TCWC). JAMAICA. no locality, 1 (BMNH); Kingston 17°58′N 76°48′W, 1 (IJ); St. Ann Parish, Queenhythe, 18°20′N 77°25′W, 2 (TTU). MEXICO. Oaxaca: Mazatlán, District of Mixes, 17°02′N 95°25′W, 1 (AMNH). Quintana Roo: 16 km from Yucatan Border, 1 (UNAM). Tabasco: Teapa, 18°35′N 92°56′W, 1 (BMNH). NICARAGUA. Mecatepe, 11°58′N 85°59′W, 1 (USNM). 1.5 km SE Yalaguina, 13°20′N 86°30′W, 1 (TCWC). PANAMA. Bocas del Toro: 7 km SSW Changuinola, 9°28′N 82°31′W, 1 (USNM). Canal Zone: Bohío, 9°10′N 79°51′W, 13 (USNM); Empire, 9°04′N 79°40′W, 1 (USNM); Fort Clayton (Fort Kobbe), 9°00′N 79°35′W, 2 (USNM); Frijoles, 9°11′N 79°48′W, 1 (USNM); Gamboa, 9°08′N 79°42′W, 1 (MVZ); Panama City, 8°57′N 79°30′W, 1 (MCZ); Paraiso, 9°02′N 79°38′W, 1 (USNM); Summit, 9°04′N 79°39′W, 1 (USNM). Darién: Tacarcuna Village, 8°05′N 77°17′W, 1 (USNM). Panamá: Tapia, 9°04′N 79°25′W, 5 (MCZ). PERU. Huánuco: Hacienda San Antonio, Río Chinchao, 9°30′S 75°56′W, 2 (FMNH); 3.2 km N Tingo María, 9°09′S 75°56′W, 1 (TCWC); Vista Alegre, 9°55′S 76°11′W, 2 (FMNH). Junín: Perené, 10°55′S 75°15′W, 5 (USNM). Loreto: Pucallpa, 8°23′S 74°32′W, 1 (FMNH). Piura: 6.4 km W Suyo, 4°33′S 80°01′W, 2 (TCWC). San Martín: Guayabamba (Santa Rosa de Huayabamba), 6°22′S 77°25′W, 4 (AMNH). SURINAM. Commewijne: Slootwijk, 5–6°N 55°W, 1 (RMNH). Nickerie: Alalapadoo, N of Sipaliwini R., 2°30′N 56°W, 6 (ROM). Plantation Wederzorg, not located, 1 (USNM). Surinam: no locality, 1 (USNM); Paramaribo, 5°52′N 55°14′W, 2 (RMNH); Welgedacht C, S of Paramaribo, 1 (RMNH). TRINIDAD. Blanchisseuse, 10°47′N 61°18′W, 1 (USNM). Maracas

Valley, 10°41′N 61°24′W, 2 (TTU); Port of Spain, 10°38′N 61°31′W, 1 (TTU). VENEZUELA. Amazonas: San Fernando de Atabapo, Upper Orinoco River, 4°03′N 67°42′W, 2 (AMNH). Bolívar: El Dorado, Río Cuyuni, 6°45′N 61°37′W, 9 (AMNH). Carbobo: 10 km NW Urama, Río Yaracuy, 10°30′N 68°19′W, 4 (USNM). Guárico: Parapara, 9°44′N 67°18′W, 1 (USNM). Zulia: Lagunillas, 10°08′N 71°16′W, 1 (FMNH).

### *Eumops auripendulus major* Eger, 1974

*Eumops auripendulus major* Eger, 1974: 2.

**Holotype**
ROM 50196 adult male; Campo Viera, Misiones, Argentina.

**Distribution**
Northern Argentina, southern Paraguay, and eastern Brazil (Fig. 15).

**Diagnosis**
Tragus shape and pelage colour similar to *E. a. auripendulus*. See Table 8 for selected means.

**Differential Diagnosis**
Larger than *E. a. auripendulus*, with longer forearm and condylobasal lengths. See Tables 7 and 8.

**Specimens Examined and Distribution Records**
ARGENTINA. Misiones: no locality, 1 (ROM); Bonpland, 27°30′S 56°00′W, 1 (ROM); Campo Viera, 27°15′S 55°10′W, 2 (ROM); Colonia Mártieres, approx. 28°S 56°W, 2 (ROM). BRAZIL. Bahia: Lamarão, 11°46′S 38°53′W, 1 (BMNH). Ceará: Baturité, 4°20′S 38°53′W, 1 (FMNH), 1 (USP); Quixadá, 4°48′S 39°01′W, 2 (FMNH). Espírito Santo: Santa Teresa, 19°55′S 40°36′W, 1 (USP). Minas Gerais: Manejo, 21°50′S 45°44′W, 2 (MCZ). São Paulo: Butantã, 1 (USP); Emas Pirassununga, 21°56′S 47°22′W, 1 (USP); Iporanga, 24°35′S 48°35′W, 1 (MCZ);

**Table 8. Selected sample statistics of *Eumops auripendulus major***

| | Male | | | Female | | |
|---|---|---|---|---|---|---|
| Character | n | $\overline{X}$ | ±S.E. | n | $\overline{X}$ | ±S.E. |
| FOAR | 8 | 64.2 | 0.70 | 10 | 63.4 | 0.47 |
| TOLG | 6 | 27.2 | 0.23 | 8 | 26.6 | 0.29 |
| CBLG | 6 | 25.0 | 0.15 | 8 | 24.8 | 0.19 |
| ZYGO | 6 | 15.4 | 0.10 | 8 | 15.1 | 0.11 |
| MAST | 5 | 13.1 | 0.15 | 8 | 13.0 | 0.12 |
| HBCA | 6 | 9.2 | 0.07 | 8 | 8.9 | 0.10 |
| C-$M^3$ | 6 | 10.3 | 0.12 | 9 | 10.1 | 0.08 |
| POCO | 6 | 4.7 | 0.06 | 9 | 4.9 | 0.07 |

Itapetininga, 23°36′S 48°07′W, 1 (MCZ); Juquiá, 24°19′S 47°38′W, 1 (USP); Ribeirão Prêto, 21°10′S 47°48′W, 4 (USP); São Paulo, 23°33′S 46°39′W, 1 (USP). PARAGUAY. Central: Recoleta, Asunción, 25°15′S 57°40′W, 3 (MVZ).

### *Eumops bonariensis* (Peters, 1874)

*Promops bonariensis* Peters, 1874: 232–34 (non *Promops* Gervais, 1855).
*Molossus bonariensis* Dobson, 1876: 715 (non *Molossus* Geoffroy, 1805).
*Eumops bonariensis* Miller, 1906: 85.
*Eumops patagonicus* Thomas, 1924: 234.

**Distribution**
Southern Mexico to central Argentina (Fig. 17).

**Diagnosis**
Smallest of the genus, forearm 37–49; third commissure on $M^3$ as long as second.

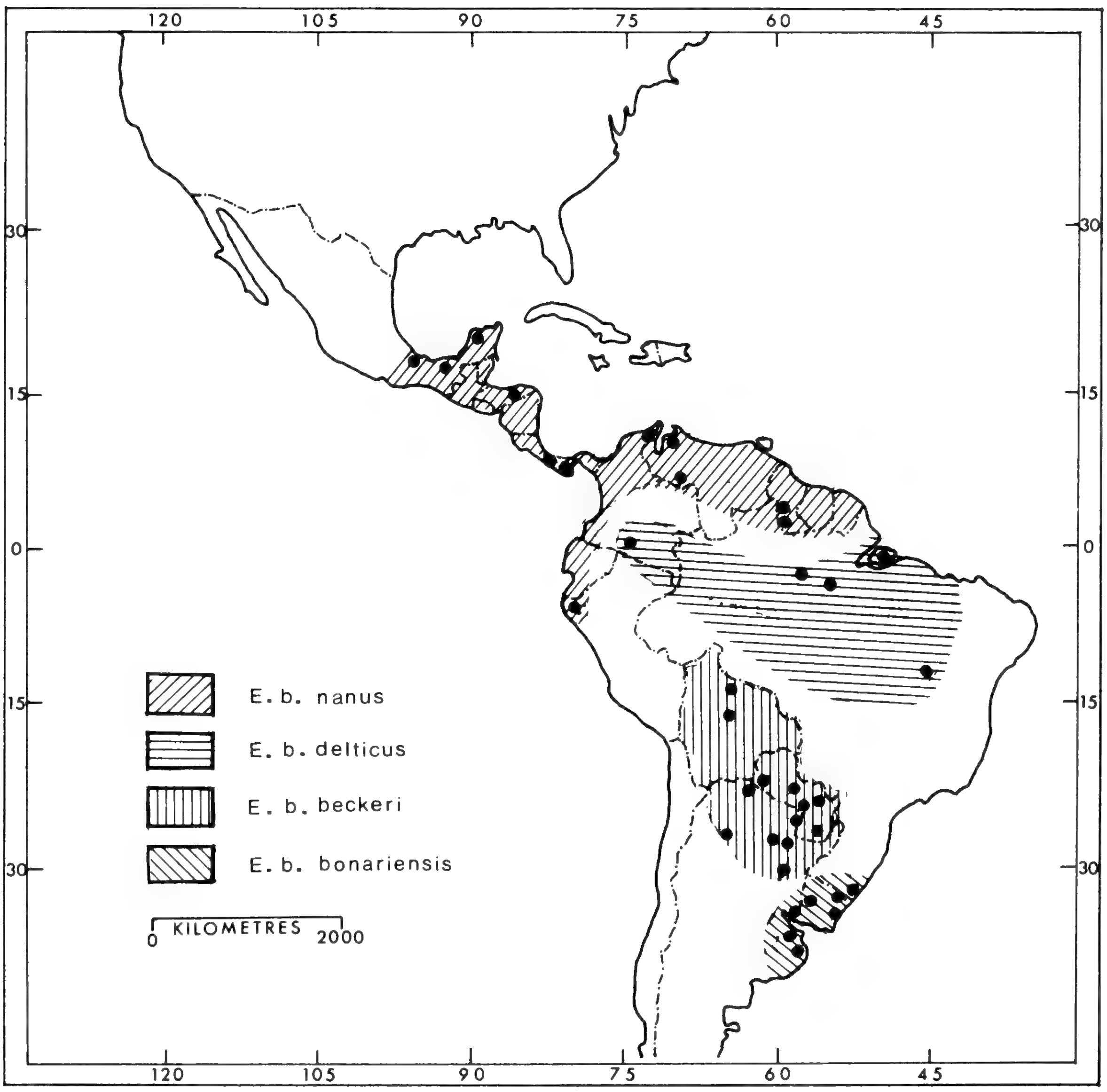


Fig. 17. Distribution of *Eumops bonariensis*. See Systematic Section for list of localities.

## *Eumops bonariensis bonariensis* (Peters, 1874)

*Eumops b. bonariensis* Sanborn, 1932: 354.

### Holotype
Whereabouts unknown adult male; Buenos Aires, Argentina.

### Distribution
Southern Brazil south to Buenos Aires region of Argentina (Fig. 17).

### Diagnosis
Pelage Snuff Brown to Bister dorsally, Buffy Brown ventrally; basisphenoid pits oval and shallow; third commissure of $M^3$ well developed, as long as second commissure. See Table 9 for selected character means.

### Differential Diagnosis
Averages larger than *E. bonariensis beckeri*, *E. bonariensis delticus*, and *E. bonariensis nanus* in all characters; distinguished by forearm and condylobasal lengths.

### Specimens Examined and Distribution Records
ARGENTINA. Buenos Aires: Delta of Paraná River, approx. 39°S 54°W, 1 (ROM); La Plata, 34°52′S 57°55′W, 1 (BMNH); Punta Lara, 50 km S Buenos Aires, 34°40′S 58°00′W, 1 (ROM). Entre Ríos: Gualeguaychu, 33°03′S 59°31′W, 1 (ROM), 1 (TCWC). BRAZIL. Rio Grande do Sul: Quinta, 32°05′S 52°17′W, 5 (AMNH). URUGUAY. Cerro Largo: Centurión, 32°06′S 53°45′W (Acosta y Lara, 1950). Río Negro: Arroyo Negro River, 15 km S Paysandú, 32°25′S 58°05′W, 8 (AMNH). Treinta-y-tres: Treinta-y-tres, 33°16′S 54°17′W, 1 (FMNH).

**Table 9. Selected sample statistics of *Eumops b. bonariensis***

| | Male | | | Female | | |
|---|---|---|---|---|---|---|
| Character | n | $\bar{X}$ | ±S.E. | n | $\bar{X}$ | ±S.E. |
| FOAR | 7 | 46.81 | 0.69 | 7 | 46.70 | 0.49 |
| TOLG | 7 | 20.44 | 0.16 | 5 | 20.08 | 0.17 |
| CBLG | 7 | 19.19 | 0.17 | 5 | 19.01 | 0.11 |
| ZYGO | 7 | 11.93 | 0.14 | 4 | 11.85 | 0.13 |
| MAST | 7 | 11.31 | 0.09 | 5 | 11.20 | 0.06 |
| HBCA | 7 | 7.29 | 0.07 | 5 | 7.22 | 0.12 |
| C-$M^3$ | 7 | 7.59 | 0.11 | 6 | 7.58 | 0.10 |
| POCO | 7 | 4.36 | 0.04 | 5 | 4.37 | 0.07 |

### *Eumops bonariensis beckeri* Sanborn, 1932

*Eumops bonariensis beckeri* Sanborn, 1932: 355.

**Holotype**
FMNH 21536 adult male; Trinidad, El Beni, Bolivia.

**Distribution**
Bolivia, Paraguay, northern Argentina (Fig. 17).

**Diagnosis**
See drawing of head (Fig. 18). Pelage Mummy Brown with grey hairs scattered throughout, paler ventrally; basisphenoid pits oval and shallow. Selected character means given in Table 10.

**Differential Diagnosis**
Similar to *E. b. bonariensis* but smaller, distinguished by shorter forearm and condylobasal lengths. Agrees with the description and measurements of *E. patagonicus* Thomas (1924). Although Cabrera (1957) stated that Chubut is a valid locality for this bat, only additional specimens from this area will establish the true status of *E. b. patagonicus*.

**Remarks**
Of three specimens of *E. bonariensis* collected 230 km NW of Villa Hayes by road, Depto. Presidente Hayes, Paraguay, two (MVZ 145109, 145110) were typical of *E. bonariensis beckeri*, but the third specimen (MVZ 145108) was intermediate in size between *E. b. bonariensis* and *E. b. beckeri*.

**Specimens Examined and Distribution Records**
ARGENTINA. No locality, 1 (MNHN). Chaco: Barrangueras, 27°29′S 58°54′W, 1 (ROM); Resistencia, 27°28′S 59°00′W, 14 (BMNH); Sáenz Peña, 26°45′S 68°30′W, 1 (ROM). Corrientes: Goya, 29°10′S 59°15′W, 5 (BMNH). Formosa: Clorinda Borrier, 26°15′S 57°45′W, 1 (ROM). Misiones: Capital Villa Lanus, 27°26′S 55°53′W, 2 (ROM). Salta: Santa Victoria Este, 22°17′S 62°44′W, 3 (ROM). Santiago del Estero: Santa Isabel, 26°20′S 64°20′W, 1 (ROM). BOLIVIA. Beni: Magdalena, Itinez, 13°22′S 64°07′W, 14 (USNM); 20 km S San Joaquín, 13°13′S 64°47′W, 1 (AMNH); Trinidad, 14°46′S 64°50′W, 2 (USNM), 8 (FMNH), 1 (MCZ), 4 (AMNH), 8 (UNAM). PARAGUAY. Chaco: Loma Plata, Menno Colony, 22°20′S 60°W, 2 (KU); Teniente Ochoa, 21°42′S 61°02′W (Wetzel and Lovett, 1974). Concepción: 8 km E Concepción, 23°22′S 57°22′W, 1 (MVZ). Guaira: Villarrica, 25°45′S 56°28′W, 1 (USNM), 1 (AMNH). Itapuá: Encarnación, 27°20′S 55°50′W, 1 (MVZ). La Cordillera: Asunción, 25°15′S 57°40′W, 13 (USNM), 3 (AMNH), 2 (ROM), 3 (FMNH), 8 (MVZ). Paraguarí: Sapucay, 25°40′S 56°55′W, 4 (BMNH). Presidente Hayes: 275 km NW Villa Hayes by road, 25°10′S 58°30′W, 10 (MVZ); 230 km NW Villa Hayes by road, 23°25′S 58°30′W, 2 (MVZ).

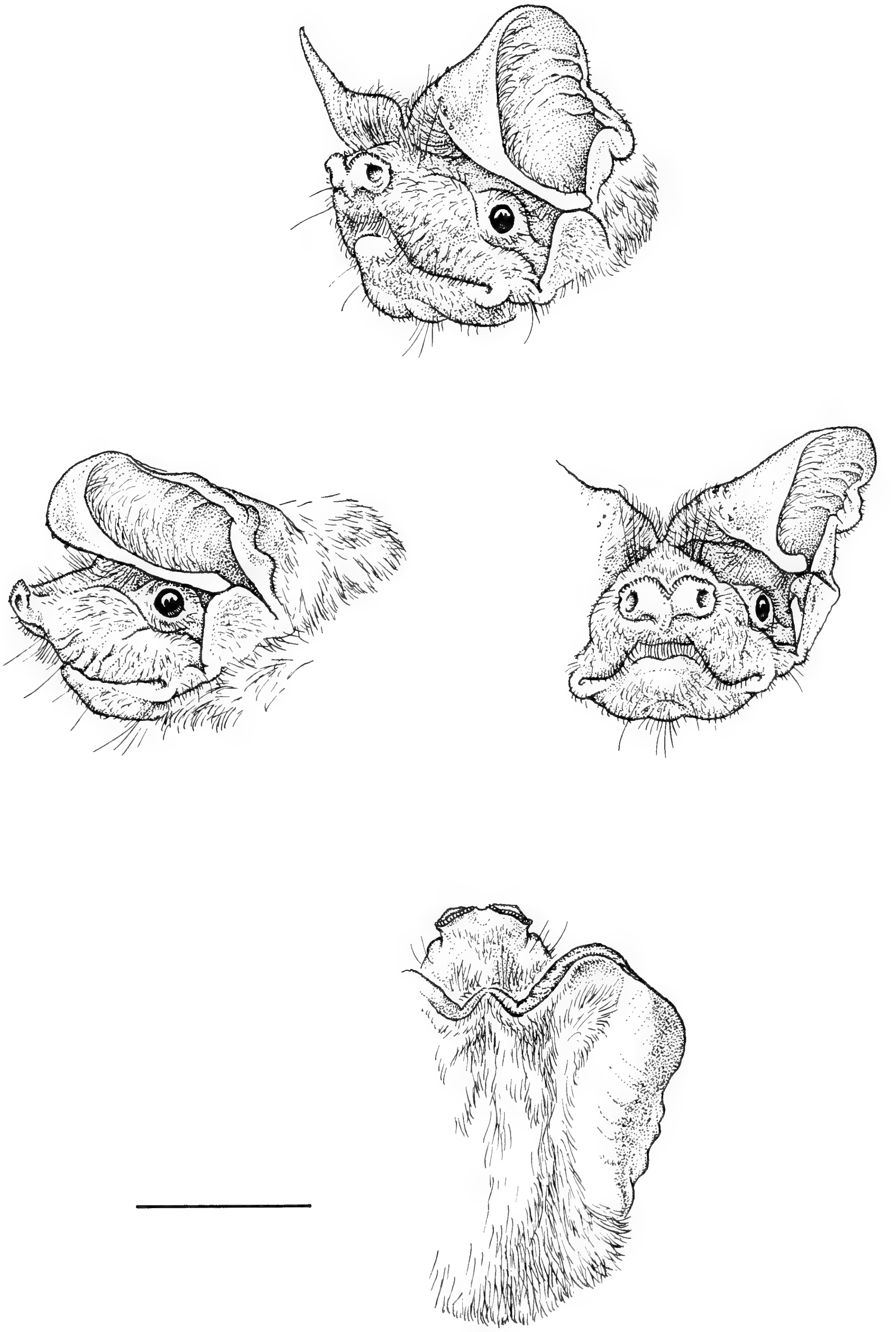

Fig. 18. *Eumops bonariensis beckeri*. Scale bar = 10 mm.

**Table 10. Selected sample statistics of *Eumops bonariensis beckeri***

| | Male | | | Female | | |
|---|---|---|---|---|---|---|
| Character | n | $\overline{X}$ | ±S.E. | n | $\overline{X}$ | ±S.E. |
| FOAR | 23 | 44.20 | 0.28 | 50 | 44.05 | 0.17 |
| TOLG | 10 | 18.30 | 0.10 | 13 | 17.89 | 0.17 |
| CBLG | 11 | 17.07 | 0.10 | 16 | 16.54 | 0.18 |
| ZYGO | 12 | 10.82 | 0.07 | 24 | 10.73 | 0.07 |
| MAST | 13 | 10.22 | 0.05 | 20 | 10.11 | 0.08 |
| HBCA | 11 | 6.46 | 0.06 | 16 | 6.42 | 0.08 |
| C-$M^3$ | 12 | 6.90 | 0.07 | 29 | 6.69 | 0.05 |
| POCO | 13 | 4.18 | 0.04 | 27 | 4.07 | 0.04 |

## *Eumops bonariensis delticus* Thomas, 1923

*Eumops delticus* Thomas, 1923: 341.
*Eumops bonariensis delticus* Sanborn, 1932: 355.

### Holotype

BMNH 23.8.9.7 adult female; Caldeirão, Marajó Island, Pará, Brazil.

### Distribution

Amazon basin of central Brazil and Colombia (Fig. 17).

### Diagnosis

Colour Snuff Brown to Blackish Brown dorsally, paler ventrally; basisphenoid pits largest of the species, elongate and shallow. Selected character means given in Table 11.

**Table 11. Selected sample statistics of *Eumops bonariensis delticus***

| | Male | | Female | | |
|---|---|---|---|---|---|
| Character | n | $\overline{X}$ | n | $\overline{X}$ | ±S.E. |
| FOAR | 3 | 45.80 | 6 | 46.33 | 0.40 |
| TOLG | 3 | 18.57 | 5 | 18.59 | 0.12 |
| CBLG | 2 | 17.50 | 3 | 17.65 | — |
| ZYGO | 3 | 10.80 | 6 | 10.76 | 0.08 |
| MAST | 2 | 9.90 | 4 | 10.10 | 0.04 |
| HBCA | 2 | 6.60 | 5 | 6.40 | 0.10 |
| C-$M^3$ | 3 | 6.77 | 6 | 6.90 | 0.09 |
| POCO | 3 | 3.80 | 6 | 3.80 | 0.08 |

**Differential Diagnosis**
Forearm length similar to that of *E. b. bonariensis* but distinguished from it by a shorter, narrower skull, longer ears, and larger basisphenoid pits.

**Specimens Examined**
BRAZIL. Bahia: São Marcelo, 11°02′S 45°32′W, 3 (FMNH). Pará: Boim, Rio Tapajós, 2°49′S 55°10′W, 1 (USP); Faro, north bank of Amazon, 2°10′S 56°39′W, 2 (AMNH); Marajó Island, Caldeirão, 0°40′S 49°30′W, 1 (BMNH). COLOMBIA. Caquetá: Tres Esquinas, 0°43′N 75°14′W, 2 (MNHU).

## *Eumops bonariensis nanus* (Miller, 1900)

*Promops nanus* Miller, 1900: 470 (non *Promops* Gervais, 1855).
*Eumops nanus* Miller, 1906: 85.
*Eumops bonariensis nanus* Sanborn, 1932: 356.

**Holotype**
BMNH 0.7.11.99 adult male; Bugaba (Bogavo), Chiriquí, Panamá.

**Distribution**
Southern Mexico, Honduras, Panama, northern Colombia, Venezuela, Guyana, and northern Peru (Fig. 17).

**Diagnosis**
Pelage Bister dorsally, paler ventrally; basisphenoid pits oval and shallow. Selected character means given in Table 12.

**Differential Diagnosis**
Smallest subspecies of *E. bonariensis*; distinguished by short forearm and skull lengths.

**Table 12. Selected sample statistics of *Eumops bonariensis nanus***

| | Male | | | Female | | |
|---|---|---|---|---|---|---|
| Character | n | $\bar{X}$ | ±S.E. | n | $\bar{X}$ | ±S.E. |
| FOAR | 12 | 39.07 | 0.50 | 15 | 39.66 | 0.45 |
| TOLG | 11 | 17.02 | 0.21 | 14 | 16.74 | 0.15 |
| CBLG | 11 | 15.76 | 0.20 | 13 | 15.60 | 0.17 |
| ZYGO | 11 | 9.96 | 0.16 | 14 | 9.80 | 0.10 |
| MAST | 10 | 9.26 | 0.16 | 13 | 9.12 | 0.08 |
| HBCA | 11 | 5.99 | 0.09 | 13 | 5.91 | 0.07 |
| $C\text{-}M^3$ | 10 | 6.27 | 0.10 | 13 | 6.23 | 0.06 |
| POCO | 11 | 3.70 | 0.10 | 13 | 3.62 | 0.06 |

**Specimens Examined and Distribution Records**

COLOMBIA. Guajira: 119 km N, 32 km W Maracaibo, Venezuela, 12°N 72°W, 2 (USNM). GUYANA. Essequibo: St Ignatius, 3°18′N 59°46′W, 1 (ROM); Kuitaro River, 48 km E Dadanawa, 2°50′N 59°29′W, 1 (ROM); Rau Wau River, 2°50′N 59°00′W, 4 (ROM). HONDURAS. Brus Laguna, Gracias á Dios, 15°40′N 84°20′W, 1 (TCWC). MEXICO. Tabasco: 18 km N, 3 km E Teapa, 17°45′N 92°50′W, 1 (LSU). Veracruz: 4–6 km ENE Tlacotalpan, 18°38′N 95°40′W, 1 (UNAM). Yucatán: 2.5 km NW Dzitya, 21°05′N 89°42′W, 1 (MMNH); Mérida, 20°59′N 89°31′W, 1 (TTU), 2 (MMNH). PANAMA. Chiriquí: Boquerón, 8°31′N 82°34′W, 1 (AMNH); Bugaba (Bogavo), 8°29′N 82°37′W, 1 (BMNH), 1 (USNM). Veraguas: Tolé, 8°16′N 81°40′W, 1 (USNM). PERU. Piura: 6.4 km W Suyo, 4°33′S 80°01′W, 1 (TCWC). VENEZUELA. Apure: La Trinidad de Arauca (Ojasti and Linares, 1971). Falcón: Capatárida, 11°15′N 70°22′W, 3 (USNM).

## *Eumops dabbenei* Thomas, 1914

*Eumops dabbenei* Thomas, 1914: 481.
*Eumops perotis dabbenei* Sanborn, 1932: 350.

**Holotype**

BMNH 14.4.4.8 adult female; Chaco Province, Argentina.

**Distribution**

Chaco Province, Argentina, Magdalena River valley in Colombia, and northern Venezuela (Fig. 19).

**Diagnosis**

See drawing of head (Fig. 20). Tragus small and pointed, about 2 mm long; pelage Cinnamon Brown dorsally, Buffy Brown ventrally; basisphenoid pits moderately well developed, oval and shallow; third commissure of $M^3$ rudimentary. See Table 13.

**Table 13. Selected character means of *Eumops dabbenei***

| | Female | |
|---|---|---|
| Character | n | $\bar{X}$ |
| FOAR | 3 | 77.10 |
| TOLG | 3 | 33.83 |
| CBLG | 2 | 30.82 |
| ZYGO | 3 | 19.47 |
| MAST | 3 | 16.43 |
| HBCA | 3 | 10.87 |
| C-$M^3$ | 3 | 13.00 |
| POCO | 3 | 5.87 |


Fig. 19. Distribution of *Eumops dabbenei* and *E. underwoodi*. See Systematic Section for list of localities.

**Differential Diagnosis**

Cabrera (1957) synonymized *E. dabbenei* with *E. p. perotis*. Size and colour similar to that of *E. p. perotis* but distinguished by shorter ears, smaller pointed tragus, heavier, more massive skull; basisphenoid pits shallower and less developed. Ears, tragus, and pelage similar to *E. underwoodi*; differentiated by larger size. *E. dabbenei* is proportionally larger than *E. underwoodi* in wing characters and smaller in skull characters. Nonetheless, a larger sample size is necessary to clarify the status of *E. dabbenei*.

**Specimens Examined**

ARGENTINA. Chaco: 1 (BMNH). COLOMBIA. Magdalena River, 1 (ANSP). VENEZUELA. Yaracuy: Carabobo, 10 km NW Urama, Río Yaracuy, 10°35′N 68°44′W, 1 (USNM).

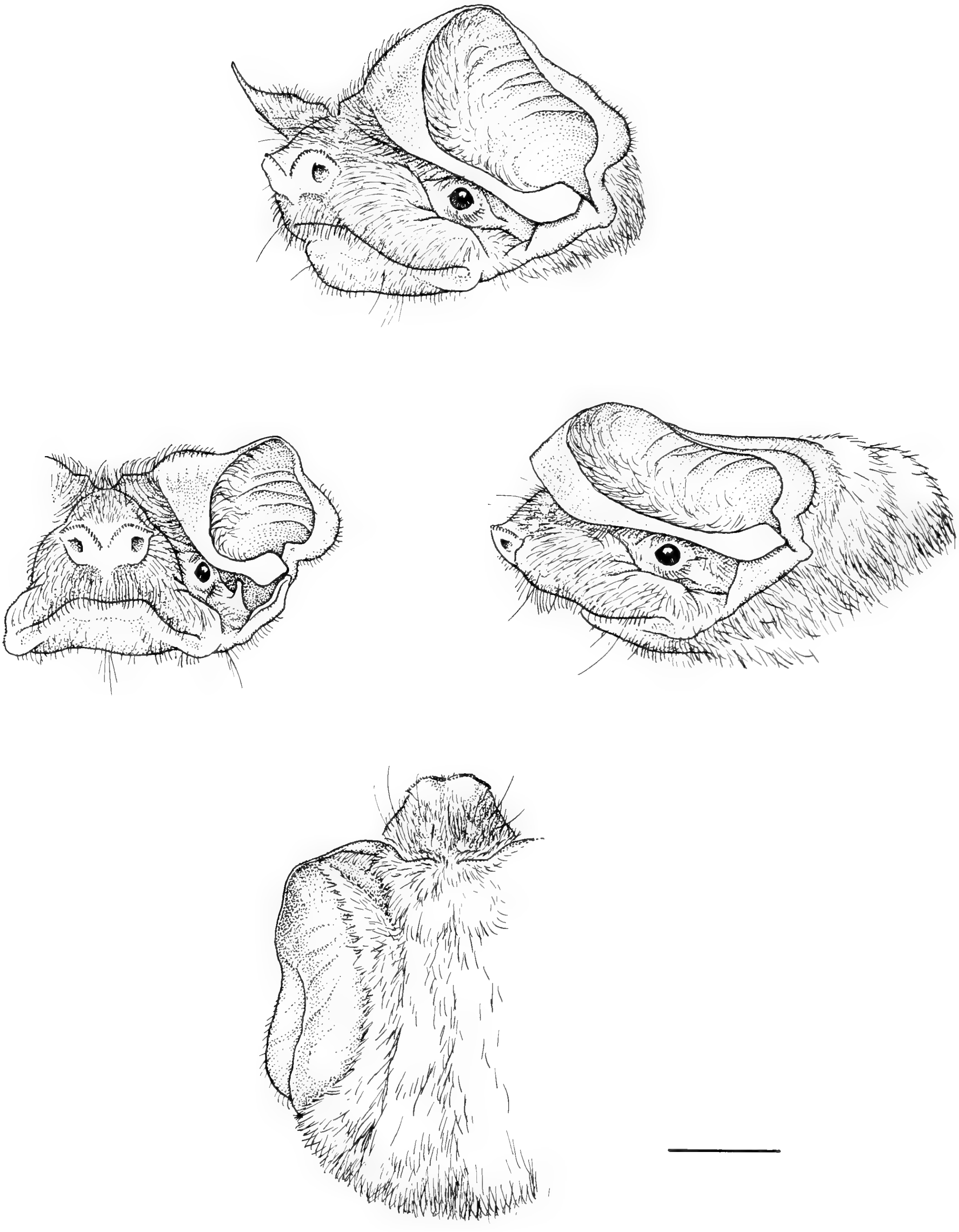

Fig. 20. *Eumops dabbenei*. Scale bar = 10 mm.

### *Eumops glaucinus* (Wagner, 1843)

*Dysopes glaucinus* Wagner, 1843: 368 (non *Dysopes* Illiger, 1811).
*Molossus ferox* Gundlach, 1861: 149 (non *Molossus* Geoffroy, 1805).
*Molossus glaucinus* Dobson, 1876: 714 (non *Molossus* Geoffroy, 1805).
*Nyctinomus orthotis* H. Allen, 1889: 561 (non *Nyctinomus* Geoffroy, 1818).
*Promops glaucinus* Miller, 1900: 471 (non *Promops* Gervais, 1855).
*Promops orthotis* Miller, 1902: 250 (non *Promops* Gervais, 1855).
*Eumops orthotis* Miller, 1906: 85.
*Eumops glaucinus* Miller, 1906: 85.

**Distribution**

Southern Florida, central Mexico, south to Peru, Bolivia, Paraguay, southeastern Brazil; Cuba and Jamaica (Fig. 21).

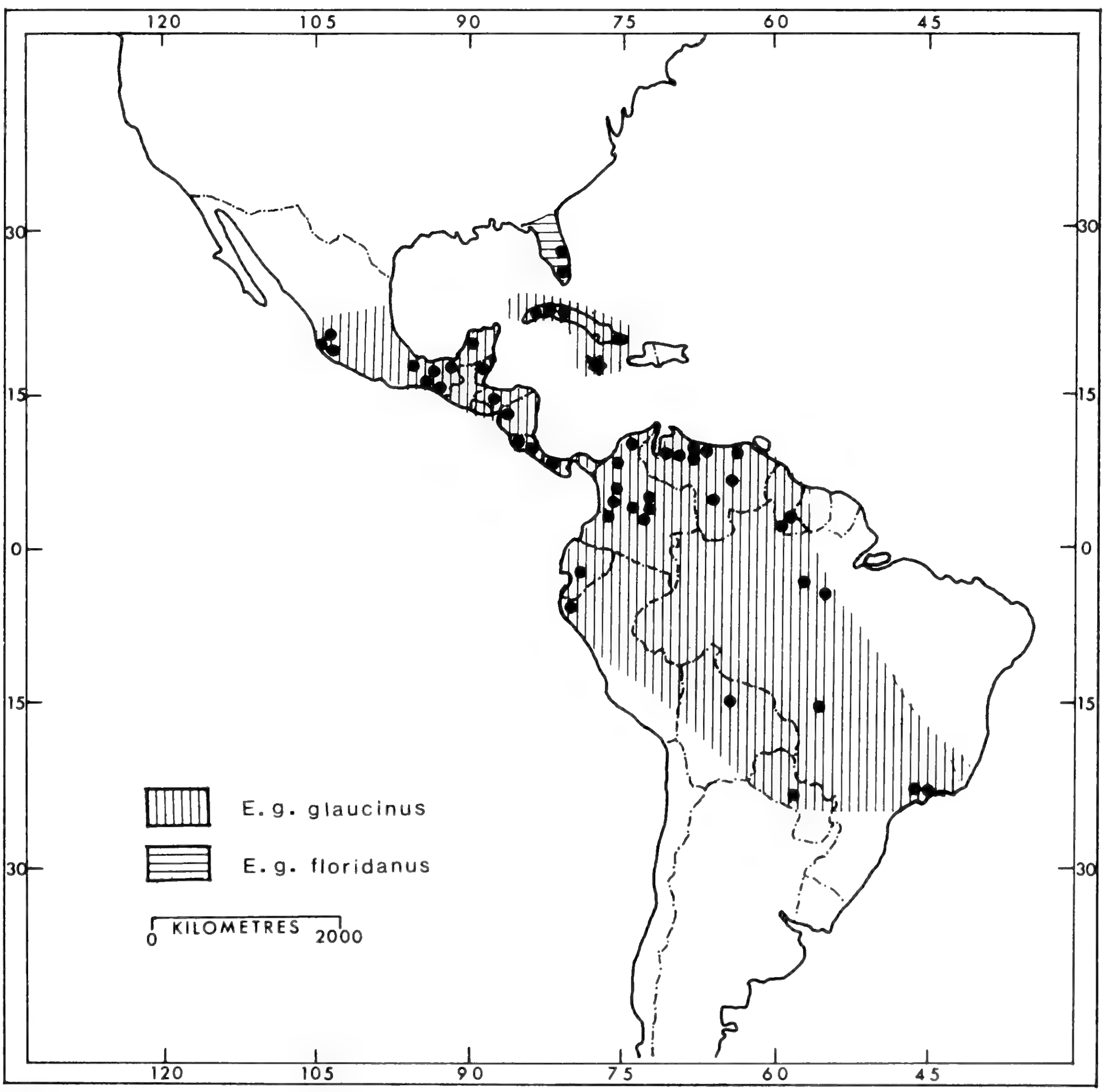


Fig. 21. Distribution of *Eumops glaucinus*. See Systematic Section for list of localities.

**Diagnosis**
Medium-sized species; forearm 56–66; pelage Snuff Brown to Sepia, with white basal band; third commissure of $M^3$ rudimentary.

**Differential Diagnosis**
Similar in size to *E. auripendulus* but differs by paler colour of pelage; square broad tragus; larger, better defined basisphenoid pits; skull longer and proportionally wider.

### *Eumops g. glaucinus* (Wagner, 1843)

*Eumops g. glaucinus* Koopman, 1971: 4.

**Holotype**
Whereabouts unknown; Cuiaba, Mato Grosso, Brazil.

**Distribution**
Central Mexico south to Peru, Bolivia, Paraguay, southeastern Brazil; Jamaica and Cuba (Fig. 21).

**Diagnosis**
See drawing of head (Fig. 22). Tragus square and broad; pelage Snuff Brown to Sepia dorsally, paler ventrally; basisphenoid pits moderately well developed, semi-oval. See Table 14 for means of selected characters.

**Differential Diagnosis**
Smaller than *E. g. floridanus*; distinguished by shorter forearm and condylobasal lengths.

**Specimens Examined and Distribution Records**
BOLIVIA. Beni: Itenez, 13°22′S 64°07′W, 2 (USNM). BRAZIL. Mato Grosso: Cuiabá, 15°35′S 56°05′W (Wagner, 1843). Minas Gerais: Sylvestre (nr. Victoria), 22°07′S 45°08′W, 1 (USNM). Pará: Faro, N bank of Amazon River, 2°10′S

**Table 14.** Selected sample statistics of *Eumops g. glaucinus*

| | Male | | | Female | | |
|---|---|---|---|---|---|---|
| Character | n | $\overline{X}$ | ±S.E. | n | $\overline{X}$ | ±S.E. |
| FOAR | 82 | 59.62 | 0.15 | 153 | 59.16 | 0.12 |
| TOLG | 68 | 24.61 | 0.07 | 119 | 24.16 | 0.05 |
| CBLG | 68 | 23.55 | 0.07 | 116 | 23.13 | 0.05 |
| ZYGO | 67 | 14.64 | 0.06 | 122 | 14.36 | 0.04 |
| MAST | 65 | 13.05 | 0.04 | 120 | 12.94 | 0.03 |
| HBCA | 68 | 8.54 | 0.04 | 122 | 8.45 | 0.03 |
| C-$M^3$ | 72 | 9.64 | 0.04 | 128 | 9.49 | 0.02 |
| POCO | 69 | 4.92 | 0.02 | 128 | 4.89 | 0.01 |

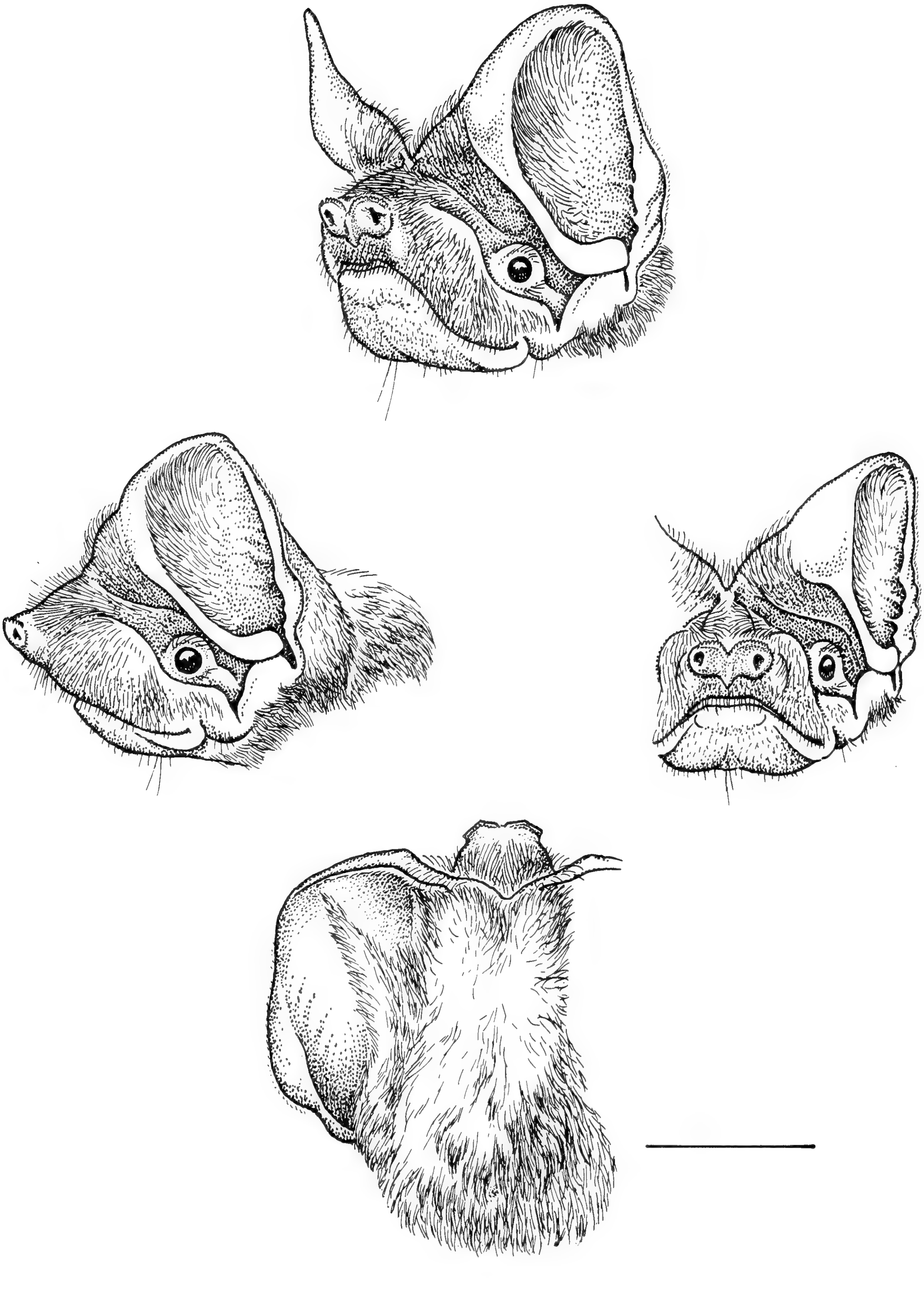

Fig. 22. *Eumops g. glaucinus.* Scale bar = 10 mm.

56°39′W, 4 (AMNH); Rio Tapajós, Piuhy, 2°24′S 54°41′W, 4 (MCZ); Rio Tapajós, Tamari, 3°05′S 55°05′W, 3 (MCV). Rio de Janeiro: Angra dos Reis, 23°S 44°18′W, 1 (USP). BELIZE. Ruinas de Xumantunioh, 1 (UNAM). COLOMBIA. Bolívar: Sincelejo, 9°17′N 75°23′W, 9 (TCWC). Boyacá: El Yopal, 5°21′N 72°23′W, 2 (ROM). Cundinamarca: Bogotá, 4°38′N 74°05′W, 1 (AMNH); Puerto Salgar, 5°28′N 74°39′W, 1 (ROM). Magdalena: Santa Marta, 11°18′N 74°10′W, 4 (AMNH). Meta: Puerto López, 4°05′N 72°58′W, 7 (ROM); Restrepo, 4°15′N 73°33′W, 2 (ROM). Tolima: Espinal, 4°09′N 74°53′W, 1 (FMNH); Honda, 5°15′N 74°50′W, 5 (AMNH). COSTA RICA. Alajuela: Cariblanca, 29 km NE Naranjo, 9°56′N 84°57′W, 4 (TCWC). Cartago: Finca la Margot, Turrialba, 9°56′N 83°40′W, 1 (TCWC). San José: 2 km NW Santa Ana (Finca Lornessa), 9°55′N 84°10′W, 19 (LSU). CUBA. No locality: 1 (AMNH), 4 (USNM); Cobre, 23°09′N 82°10′W, 1 (AMNH); Guatánamo, 20°09′N 75°14′W, 20 (USNM), 3 (AMNH); Habana, 23°07′N 82°05′W, 1 (USNM); Los Palacios River, 22°35′N 83°16′W, 3 (YPM), 1 (AMNH); Madruga, 22°55′N 81°51′W, 1 (MCZ); Pinar del Río, 22°24′N 83°42′W, 1 (USNM). ECUADOR. Guayas: Guayquil, 2°13′S 79°54′W, 1 (USNM), 1 (AMNH). GUYANA. Essequibo, Rupununi: Achamere Wau, 2°45′N 59°20′W, 6 (ROM); Aroquoi Tributary, Rupununi R., 3°N 59°30′W, 8 (ROM) Rewa River, 3°15′N 58°30′W, 2 (ROM). HONDURAS. Comayagua: 1 km W Comayagua, 14°30′N 87°39′W, 4 (TCWC); La Paz, 14°20′N 87°40′W, 2 (AMNH). Cisco Morzan: 16 km N Tegucigalpa, 14°20′N 87°10′W, 1 (TTU). JAMAICA. Kingston: 17°58′N 76°48′W, 2 (IJ); Spanish Town, 17°59′N 76°58′W, 2 (USNM); St. Andrew, 1 (USNM), 1 (MCZ). St. Ann Parish: Queenhythe, 18°20′N 77°25′W, 5 (TTU). MEXICO. Morelos, 1 (USNM). Chiapas: Palenque, 17°32′N 91°59′W, 1 (FMNH); 19 km E Ortiz Rubio on Villa Flores Road, 16°15′N 93°12′W, 2 (UA); Rancho San Fernando, 42 km W Cintalapa, 16°42′N 94°05′W, 4 (UA); 10 km SE Tonalá, 16°08′N 93°41′W, 2 (LACM), 3 (UA); 4.8 km E Cintalapa, 16°42′N 96°45′W, 1 (TCWC). Colima: La Gloria, 29 km W Pueblo Juárez, 19°10′N 104°12′W, 1 (UNAM), 1 (UA); La Jala, 2 (UA); Las Juntas, 5 km SE Pueblo Juárez, 3 (UA), 2 (TTU); Las Juntas, 26 km W Pueblo Juárez, 4 (UNAM); Río Armería, 8 km N Tecomán, 19°00′N 103°50′W, 1 (LSU); Pueblo Juárez, 2 (UA); La Sidra near Agua Zarca, 19°12′N 103°55′W, 1 (LACM). Vera Cruz: Jesús Carranza, 17°28′N 95°01′W, 3 (KU); 36 km W Puente Nacional, 19°20′N 96°50′W, 3 (TTU). Yucatán: Hacienda Calcehtok, 20°34′N 89°55′W, 1 (UNAM); 6 km S, 5 km W Kinchilil, 20°50′N 89°59′W, (Birney *et al.*, 1974); Mérida, 20°59′N 89°31′W (Birney *et al.*, 1974). NICARAGUA. 1.5 km SE Yalaguina, 13°20′N 86°30′W, 1 (TCWC). PANAMA. Chiriquí: Progreso, 8°29′N 82°50′W, 2 (USNM). PARAGUAY. Presidente Hayes: 275 km NW Villa Hayes by road, 23°10′S 58°30′W, 5 (MVZ). PERU. Piura: 6 km W Suyo, 4°33′S 80°01′W, 14 (TCWC). VENEZUELA. Amazonas: Río Manapiare, San Juan, 5°10′N 66°12′W, 37 (USNM). Bolívar: 2 km NE Maripa, 7°26′N 65°09′W, 1 (KU). Carabobo: Montalbán, 10°13′N 68°20′W, 4 (USNM). Distrito Federal: Caracas, 10°35′N 66°56′W, 1 (USNM); Chichiriviche, 10°33′N 67°14′W, 1 (UCV). Lara: Río Tocuyo, 10°18′N 70°00′W, 4 (AMNH). Sucre: Cumaná, 10°29′N 64°12′W, 1 (KU). Yaracuy: 8 km N, 18 km W San Felipe, near Aroa, 10°26′N 68°54′W, 7 (USNM). Zulia: 1 (USNM).

## *Eumops glaucinus floridanus* (Allen, 1932)

*Molossides floridanus* Allen, 1932: 257.
*Eumops floridanus* Ray *et al.*, 1963: 377.
*Eumops glaucinus floridanus* Koopman, 1971: 4.

### Holotype
MCZ 17672; stratum 2, Melbourne bed, Melbourne, Brevard Co., Florida.

### Current Distribution
Miami area, Florida (Fig. 21).

### Diagnosis
Tragus square and broad; basisphenoid pits moderately well developed, shallow and oval; third commissure of $M^3$ is one-fourth the length of the second commissure. See Table 15 for means of selected characters.

### Differential Diagnosis
Similar to *E. g. glaucinus* but larger; separable by forearm and condylobasal lengths.

### Specimens Examined and Distribution Records
UNITED STATES. Florida: Brevard Co., Melbourne, 28°04′N 80°38′W (Allen, 1932); Dade Co., Miami, 25°47′N 80°07′W, 9 (AMNH), 5 (FMNH), 12 (UM).

**Table 15. Selected sample statistics of *Eumops glaucinus floridanus***

| | Male | | |
|---|---|---|---|
| Character | n | $\overline{X}$ | ±S.E. |
| FOAR | 20 | 64.27 | 0.28 |
| TOLG | 12 | 26.85 | 0.12 |
| CBLG | 12 | 25.52 | 0.11 |
| ZYGO | 12 | 16.40 | 0.10 |
| MAST | 12 | 14.13 | 0.05 |
| HBCA | 12 | 9.06 | 0.09 |
| $C\text{-}M^3$ | 12 | 10.55 | 0.06 |
| POCO | 12 | 5.23 | 0.04 |

## *Eumops hansae* Sanborn, 1932

*Eumops hansae* Sanborn, 1932: 356.
*Eumops amazonicus* Handley, 1955: 177.
*Eumops hansae* Gardner *et al.*, 1970: 726.

### Holotype

USNM 200993 adult male; Colonia Hansa, near Joinville, Santa Caterina, Brazil.

### Distribution

Brazil, Guyana, Venezuela, Costa Rica, and Panama (Fig. 23).

### Diagnosis

See drawing (Fig. 24). Tragus broad and square; pelage rich Blackish Brown dorsally, paler ventrally; ventral hair tricoloured; basisphenoid pits well developed, sharply defined, deep; third commissure of $M^3$ well developed, as long as the second. Sexual dimorphism pronounced. See Table 16.


Fig. 23. Distribution of *Eumops hansae*. See Systematic Section for list of localities.

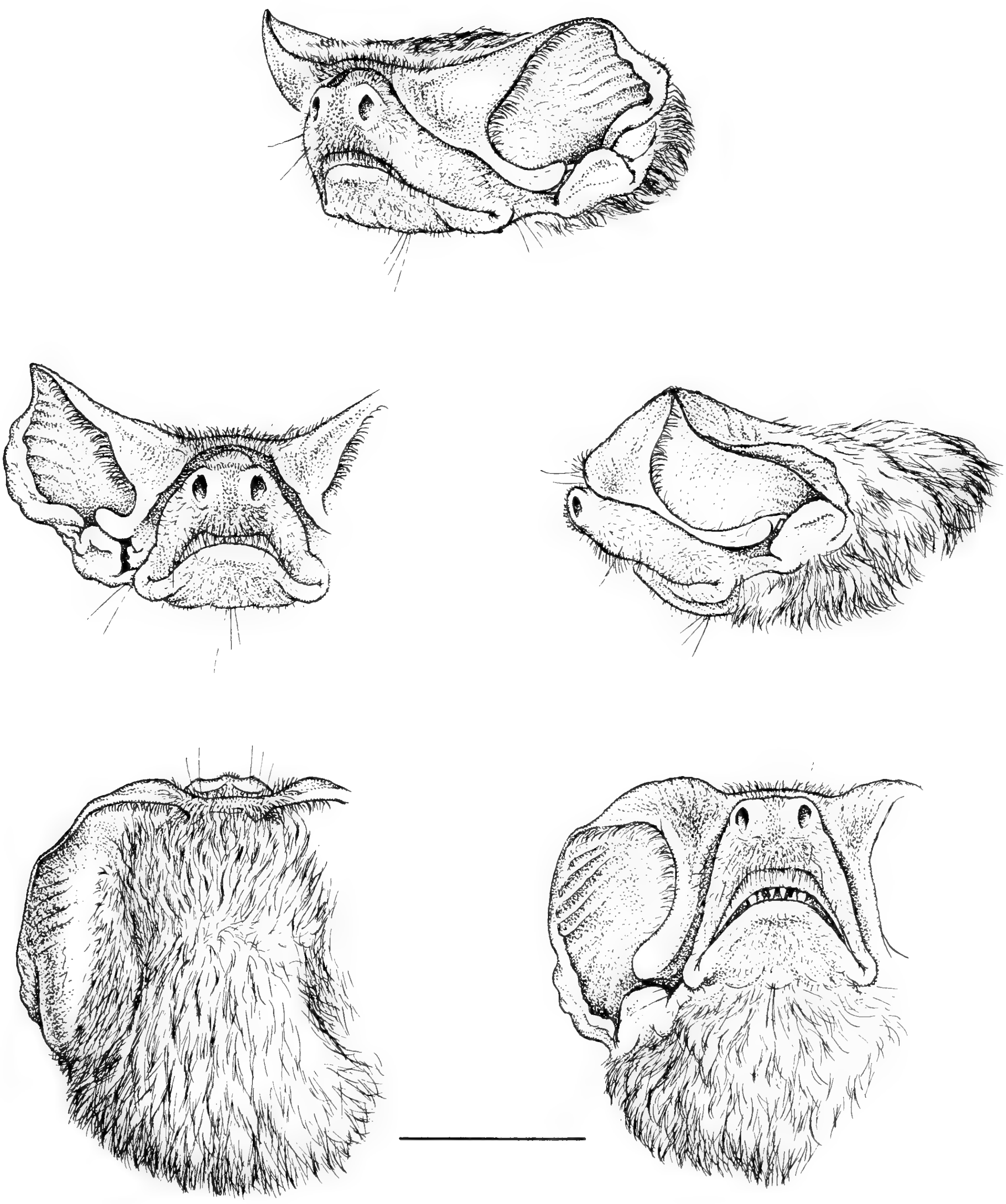

Fig. 24. *Eumops hansae*. Scale bar = 10 mm.

Table 16. **Selected sample statistics of *Eumops hansae***

| | Male | | Female | | |
|---|---|---|---|---|---|
| Character | n | $\bar{X}$ | n | $\bar{X}$ | ±S.E. |
| FOAR | 3 | 41.23 | 5 | 37.80 | 0.34 |
| TOLG | 3 | 20.87 | 4 | 18.86 | 0.20 |
| CBLG | 3 | 19.77 | 4 | 17.90 | 0.12 |
| ZYGO | 3 | 12.13 | 3 | 10.83 | — |
| MAST | 3 | 10.68 | 4 | 9.90 | 0.09 |
| HBCA | 3 | 7.00 | 4 | 6.05 | 0.06 |
| C-$M^3$ | 3 | 7.60 | 4 | 6.89 | 0.08 |
| POCO | 3 | 4.20 | 4 | 4.00 | 0.04 |

**Differential Diagnosis**

Similar in size to *E. bonariensis*, but skull is proportionally longer; basisphenoid pits longer and deeper; pelage colour much darker.

**Specimens Examined**

BRAZIL. Amazonas: Manaus, 3°08′S 60°00′W, 1 (USNM). Santa Catarina: Colonia Hansa, near Joinville (Corupa), 26°26′S 49°14′W, 1 (USNM). COSTA RICA. Puntarenas, 16 km S Palmar Sur, 10°N 84°50′W, 1 (LSU). GUYANA. Essequibo: Ishi Wau, Maruranau, 2°45′N 59°10′W, 1 (ROM). Demerara: Arampa, 5 km S Ituni, 5°28′N 58°15′W, 2 (ROM). PANAMA. Darién: Tacarcuna Village, 8°05′N 77°17′W, 1 (USNM). VENEZUELA. Bolívar: 59 km SE El Dorado, 6°20′N 61°30′W, 1 (USNM).

## *Eumops maurus* (Thomas, 1901)

*Molossus maurus* Thomas, 1901: 141 (non *Molossus* Geoffroy, 1805).
*Myopterus maurus* Trouessart, 1904: 101 (non *Myopterus* Oken, 1816).
*Eumops maurus* Miller, 1906: 85.
*Eumops geijskesi* Husson, 1962: 246.

**Holotype**

BMNH 1.6.4.34 adult male; Kanuku Mountains, Guyana.

**Distribution**

Guyana and Surinam (Fig. 25).

**Diagnosis**

Pelage dark Chocolate Brown dorsally and ventrally; narrow band of white hair (5 mm) along the ventro-lateral sides of the body and the proximal part of the mesopatagium between the humerus and femur; basisphenoid pits oval, shallow, moderately well developed; small anterior upper premolar is absent in holotype but present in specimens from Surinam. See Table 17 for selected character means.

**Table 17. Selected character means of *Eumops maurus***

| Character | Male | | Female | |
|---|---|---|---|---|
| | n | $\bar{X}$ | n | $\bar{X}$ |
| FOAR | 1 | 53.00 | 2 | 51.90 |
| TOLG | 1 | 21.70 | 2 | 20.70 |
| CBLG | 1 | 20.10 | 2 | 19.10 |
| ZYGO | 1 | 12.35 | 2 | 12.35 |
| MAST | 1 | 10.50 | 2 | 10.82 |
| HBCA | 1 | 7.70 | 1 | 7.20 |
| $C\text{-}M^3$ | 1 | 8.20 | 2 | 8.27 |
| POCO | 1 | 3.95 | 2 | 4.12 |


Fig. 25. Distribution of *Eumops maurus*. See Systematic Section for list of localities.

**Differential Diagnosis**
Resembles *E. a. auripendulus* in pelage colour and shape of skull but is smaller, with a unique ventro-lateral band of white fur.

**Remarks**
A specimen reported as *E. maurus* (Villa R., 1956) was subsequently identified as *E. auripendulus oaxacensis* by Jones *et al.* (1973).

**Specimens Examined**
GUYANA. Essequibo: Kanuku Mountains, 1 (BMNH). SURINAM. No locality, 2 (RMNH).

### *Eumops perotis* (Schinz, 1821)

*Molossus perotis* Schinz, 1821: 870 (non *Molossus* Geoffroy, 1805).
*Dysopes perotis* Wied, 1827: 227 (non *Dysopes* Illiger, 1811).
*Dysopes (Molossus) gigas* Peters, 1864: 381.
*Promops perotis* Thomas, 1901: 191 (non *Promops* Gervais, 1855).
*Eumops perotis* Miller, 1906: 85.

**Distribution**
Southern regions of California, Arizona, New Mexico, and Texas; northern Mexico, Venezuela, Ecuador, Peru, Paraguay, Bolivia, northern Argentina, and southern Brazil (Fig. 26).

**Diagnosis**
Size large; forearm 75–83; colour Olive-Brown; tragus broad and square; third commissure of $M^3$ is one-fourth the length of the second; basisphenoid pits are elongate, deep.

**Differential Diagnosis**
See account for *E. dabbenei* (page 37).

### *Eumops perotis perotis* (Schinz, 1821)

*Eumops p. perotis* Sanborn, 1932: 349.
*Eumops perotis renatae* Pirlot, 1965: 5.

**Holotype**
AMNH 435; Villa São Salvador, Campos dos Goitacazes, Rio Paraiba, Rio de Janiero, Brazil.

**Distribution**
Northern Venezuela, Paraguay, northern Argentina, southern Brazil, Bolivia, and east of the Andes in Ecuador and Peru (Fig. 26).

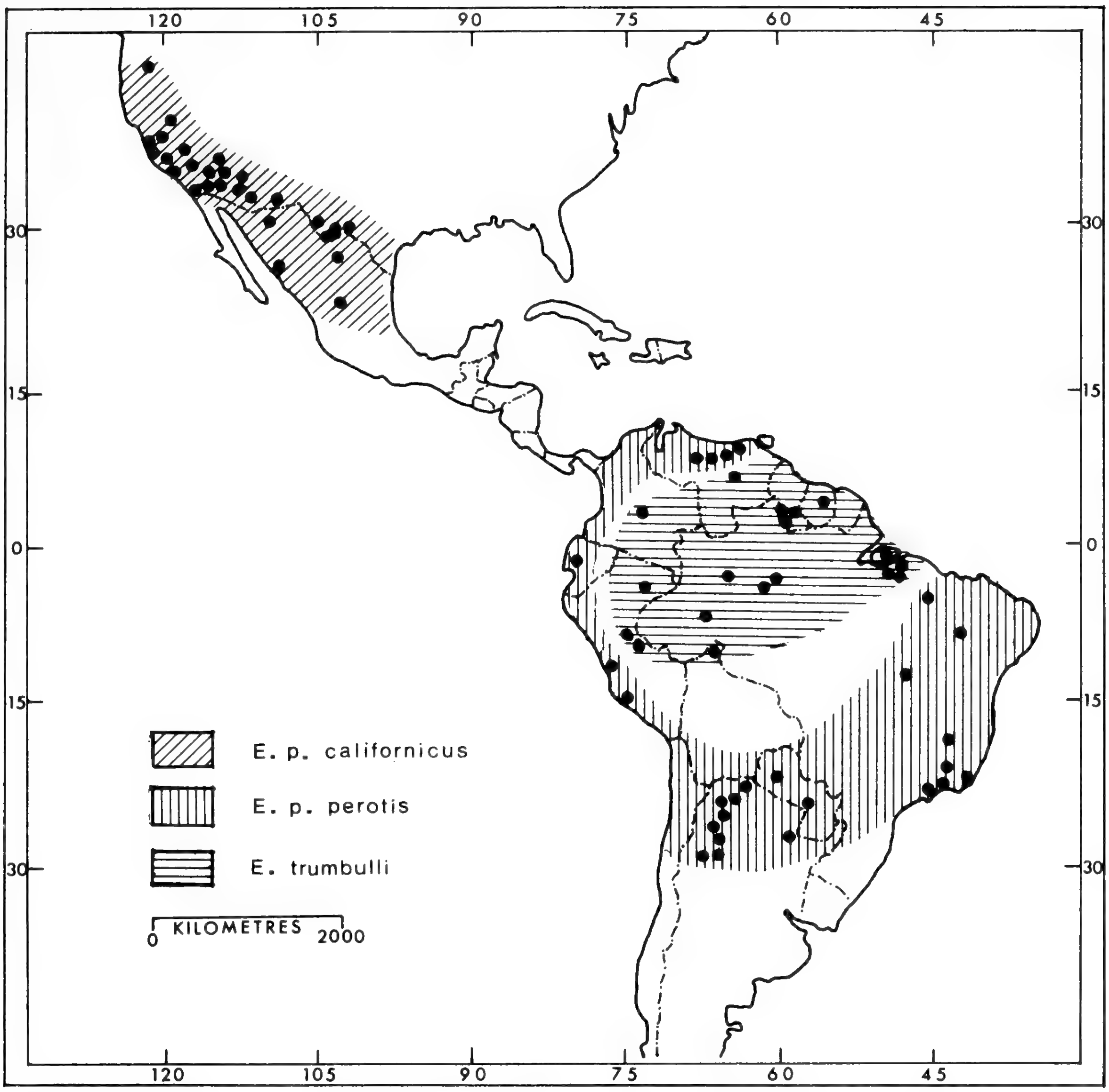


Fig. 26. Distribution of *Eumops perotis* and *E. trumbulli*. See Systematic Section for list of localities.

### Diagnosis

See drawing (Fig. 27). Tragus square and broad; pelage Olive-Brown; paler basal band; basisphenoid pits well developed, elongate, deep. See Table 18 for selected character means.

### Differential Diagnosis

Similar to *E. perotis californicus* but differs by larger body, forearm, and skull; relatively wider rostrum.

### Specimens Examined and Distribution Records

ARGENTINA. Chaco: General Vedia, 26°56′S 58°40′W, 3 (ROM), 1 (TCWC). Jujuy: Libertador General San Martín, 23°50′S 64°45′W, 1 (ROM); San Salvador de Jujuy, 24°10′S 65°48′W, 1 (UNAM); Yuto, 23°38′S 64°28′W, 1 (AMNH). Salta: Dragones, 23°15′S 63°15′W, 2 (ROM), 1 (UNAM); Salta, 24°46′S 65°28′W, 1 (ROM); 30 km NE Salta, 24°30′S 65°05′W, 1 (UNAM); Campo Santo, 24°36′S 65°09′W, 8 (ROM), 3 (TCWC). Santiago del Estero: Nueva Esperanza, 26°10′S

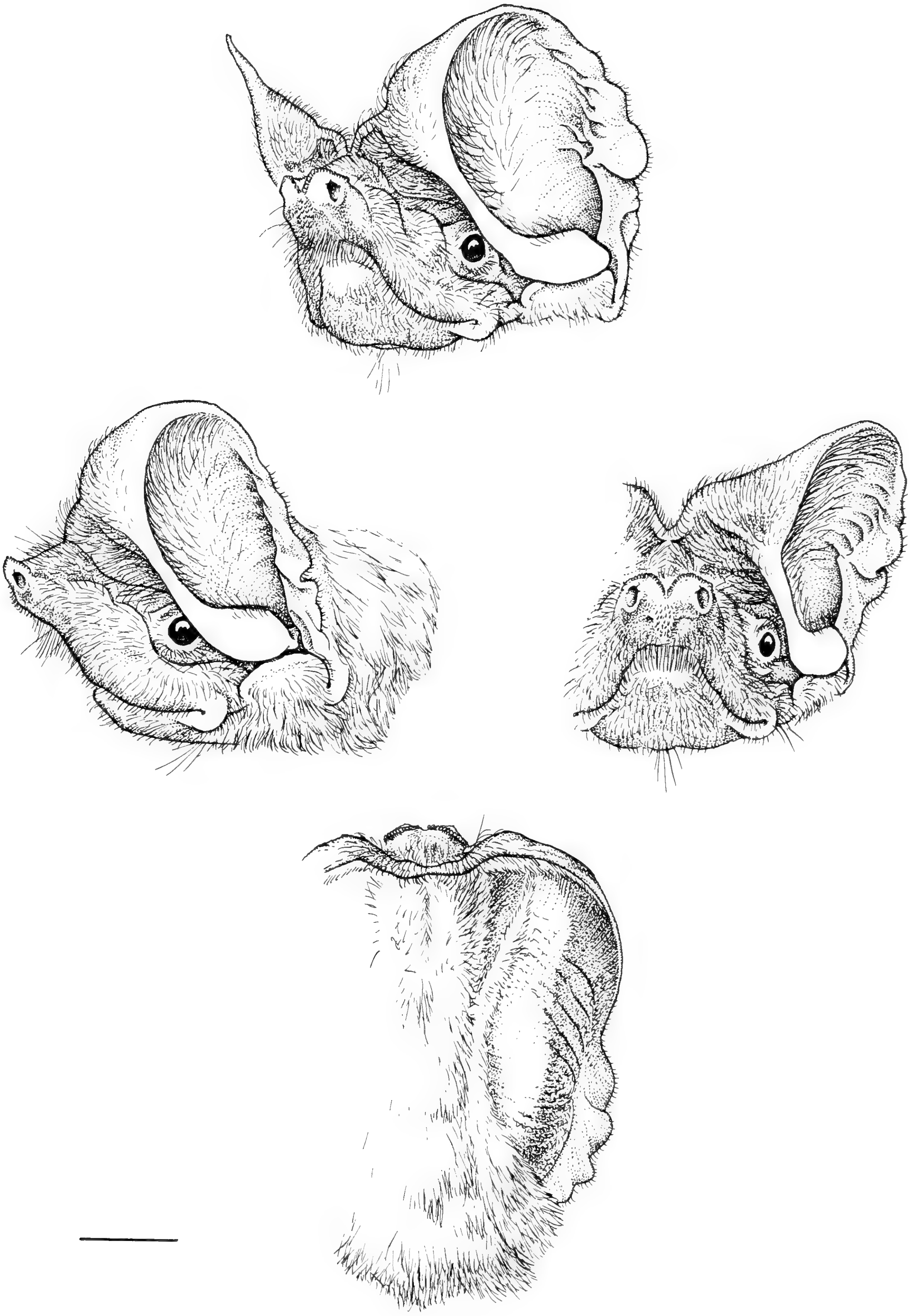

Fig. 27. *Eumops p. perotis*. Scale bar = 10 mm.

Table 18. **Selected sample statistics of *Eumops p. perotis***

| Character | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | n | $\overline{X}$ | ±S.E. | n | $\overline{X}$ | ±S.E. |
| FOAR | 21 | 80.22 | 0.49 | 33 | 78.56 | 0.35 |
| TOLG | 13 | 33.67 | 0.17 | 27 | 32.52 | 0.11 |
| CBLG | 13 | 32.12 | 0.17 | 27 | 31.03 | 0.11 |
| ZYGO | 15 | 19.04 | 0.13 | 29 | 18.41 | 0.08 |
| MAST | 12 | 15.75 | 0.12 | 25 | 15.40 | 0.07 |
| HBCA | 13 | 10.20 | 0.11 | 28 | 9.80 | 0.07 |
| C-$M^3$ | 16 | 13.14 | 0.11 | 29 | 12.81 | 0.05 |
| POCO | 15 | 5.49 | 0.05 | 28 | 5.35 | 0.04 |

64°20′W, 3(ROM). Tucumán: Concepción, 27°20′S 65°35′W, 1 (FMNH); Tucumán, 26°47′S 65°15′W, 2 (BMNH). BOLIVIA. No locality, 1 (BMNH). BRAZIL. Goiás: Parano do Manhana, 12°43′S 46°25′W, 1 (IRSNB). Maranhão: Barra do Corda, 5°30′S 45°05′W, 5 (FMNH). Minas Gerais: Mariana, 20°23′S 43°25′W, 1 (USP); Lagoa Santa, 19°39′S 43°44′W, 1 (USNM), 5 (FMNH); Rio Velhas, 17–20°S 44°W, 13 (MCZ). Piauí: Sete Lagoas, 8°27′S 41°42′W, 1 (BMNH). Rio de Janeiro: Universidade Rural (km 47), 22°51′S 43°47′W, 1 (UNAM); Rio de Janeiro, 22°53′S 43°17′W, 1 (MCZ); Villa São Salvador, Campos dos Goitacazes, 21°49′S 41°16′W (Schinz, 1821). ECUADOR. Guayas: Guayaquil, 2°12′S 79°53′W, 2 (MNHN). PARAGUAY. Chaco: Filadelfia, 22°17′S 60°03′W, 1 (FMNH). Central: Asunción, 25°15′S 57°40′W, 1 (FMNH). PERU. Huancavelica: Cordóva, 14°01′S 75°10′W, 1 (BMNH). Lima: Lima, 12°06′S 77°03′W (de la Puente, 1951). VENEZUELA. Anzoátegui: Cantaura, 9°19′N 64°21′W, 1 (USNM). Araqua: San Sebastián, 9°56′N 67°15′W (Linares, 1968). Sucre: Cumaná, 10°29′N 64°12′W, 1 (KU).

## *Eumops perotis californicus* (Merriam, 1890)

*Molossus californicus* Merriam, 1890: 31 (non *Molossus* Geoffroy, 1805).
*Promops perotis californicus* H. Allen, 1893: 175 (non *Promops* Gervais, 1855).
*Promops californicus* Miller and Rehn, 1902: 271.
*Eumops californicus* Miller, 1906: 85.
*Eumops perotis californicus* Sanborn, 1932: 351.

### Holotype
USNM 186448 adult female; Alhambra, Los Angeles County, California.

### Distribution
Southern regions of California, Arizona, New Mexico, and Texas; and Northern Mexico (Fig. 26).

Table 19. Selected sample statistics of *Eumops perotis californicus*

| Character | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | n | $\bar{X}$ | ±S.E. | n | $\bar{X}$ | ±S.E. |
| FOAR | 40 | 76.11 | 0.29 | 102 | 75.12 | 0.16 |
| TOLG | 28 | 32.29 | 0.10 | 66 | 31.40 | 0.05 |
| CBLG | 27 | 31.31 | 0.11 | 66 | 30.37 | 0.06 |
| ZYGO | 29 | 18.00 | 0.08 | 72 | 17.58 | 0.04 |
| MAST | 28 | 15.44 | 0.06 | 62 | 15.12 | 0.03 |
| HBCA | 26 | 9.03 | 0.04 | 66 | 8.98 | 0.03 |
| C-$M^3$ | 33 | 12.41 | 0.05 | 81 | 12.23 | 0.03 |
| POCO | 33 | 5.04 | 0.03 | 73 | 5.00 | 0.02 |

**Description**

Tragus square and broad; pelage Olive-Brown. See Table 19 for selected character means.

**Differential Diagnosis**

See account for *E. p. perotis* (p. 49).

**Specimens Examined and Distribution Records**

MEXICO. Coahuila: nr. Cuatro Ciénegas (Gilmore, 1947); Acatita, 26°26′N 102°59′W, 1 (UNAM). Sinaloa: 1665 km marker, Mexico Hwy. 15, few miles S of Sonoran Border, 1 (TTU). Sonora: Pilares, 30°36′N 109°25′W, 7 (UMMZ); Río Alamos, approx. 29°N 110°W, 1 (TTU). Zacatecas: Santa Rosa, 23°12′N 103°10′W (Matson and Patten, 1975). UNITED STATES. Arizona: Greenlee Co., 0.15 km (0.25 mi) N Pumo Station, Eagle Creek, 1 (UA); Maricopa Co., Scottsdale, 33°25′N 111°55′W, 1 (UA), 2 (USNM); Mohave Co., Secret Pass, near Kingman, 35°12′N 114°02′W, 2 (UI), 8 (UA); Pima Co., Santa Catalina Mts., Sabino, 32°23′N 110°50′W, 4 (UA); Tucson area, 32°15′N 110°57′W, 3 (UA), 1 (USNM); Pinal Co., Casa Grande Rim, Coolidge, 32°52′N 111°46′W, 1 (UA); Yuma Co., Parker, 34°09′N 114°18′W, 1 (USNM); Yuma, 32°40′N 114°39′W, 1 (USNM). California: No locality, 1 (USNM); Colorado Desert, Dos Cabasas, 33°N 115–116°W, 1 (USNM); Alameda Co., Hayward, 37°40′N 122°07′W, 1 (USNM); Butte Co., Oroville, 39°31′N 121°34′W, "A. Beck, personal communication, 1973"; Fresno Co., Fresno, 30°41′N 119°47′W, 1 (MVZ); Trimmer, 1 (MVZ); Imperial Co., 38.6 km (24 mi) S Palo Verde, 33°13′N 114°44′W, 1 (MVZ); Kern Co., 1.6 km (1 mi) SW Democrat Springs, Kern River, 8 (MVZ); 16 km (10 mi) NW Taft, 35°08′N 119°28′W, 1 (ROM), 1 (LSU); Los Angeles Co., Alhambra, 34°05′N 118°08′W, 2 (USNM), 1 (AMNH), 1 (UI); Azusa, 34°08′N 117°51′W, 4 (USNM), 1 (MCZ), 1 (AMNH), 2 (LSU); Covina, 34°05′N 117°52′W, 4 (FMNH), 12 (USNM), 4 (UI), 2 (MVZ), 1 (AMNH); Los Angeles, 34°00′N 118°15′W, 1 (AMNH), 16 (USNM), 1 (LSU); Pasadena, 34°10′N 118°09′W, 4 (MVZ); Pomona, 34°04′N 117°45′W, 7 (UMMZ), 1 (KU); Sierra Madre, 6 (MVZ); Monterey Co., Camphora, 3.2 km (2 mi) N Soledad, 36°25′N 121°20′W, 1 (MVZ); Orange Co., Santa Ana, 33°44′N 117°54′W, 1 (ROM); Riverside Co., 6.4 km (4 mi) SW Lakeview, 33°59′N 117°22′W, 2 (KU); San Benito Co., Silver

Creek, 12 km (7.5 mi) ESE Panoche, 36°36′N 120°50′W, 9 (MVZ); San Bernardino Co., Colton, 34°05′N 117°20′W, 1 (UI), 1 (KU); San Diego Co., 2.4 km (1.5 mi) N Barrett Junction, 32°37′N 116°42′W, 3 (MVZ), 1 (KU); San Diego, nr Dulzura, 32°39′N 116°46′W, 4 (FMNH); Mariposa, 37°30′N 119°58′W, 1 (ANSP). New Mexico: Hidalgo Co., 51 km (32 mi) S, 0.8 km (0.5 mi) E Rodeo, 31°30′N 109°02′W (Rowlett, 1972). Texas: Brewster Co., Chilicotal Mts., Big Bend National Park, 2 (TCWC); Black Gap Wildlife Refuge, 29°30′N 102°50′W, 3 (DMNH); Presidio Co., 3.2 km (2 mi) NE Candelaria, 30°15′N 104°42′W, 12 (TCWC), 12 (ROM); Valverde Co., Langtry, 29°49′N 101°36′W, 1 (USNM).

## *Eumops trumbulli* (Thomas, 1901)

*Promops trumbulli* Thomas, 1901: 190 (non *Promops* Gervis, 1855).
*Eumops trumbulli* Miller, 1906: 85.
*Eumops perotis trumbulli* Sanborn, 1932: 350.
*Eumops trumbulli* Sanborn, 1949: 283.

### Holotype

BMNH 99.11.2.1 immature male; Pará, Brazil.

### Distribution

Guyana, southern Venezuela; Amazon basin of Brazil, Colombia, Bolivia, and Peru (Fig. 26).

### Diagnosis

Pelage Olive-Brown to Buffy Brown; tragus broad, and square; basisphenoid pits well developed, elongate, deep; third commissure of $M^3$ half the length of the second. See Table 20 for character means.

### Differential Diagnosis

Similar to *E. p. perotis* but smaller, third commissure of $M^3$ longer than in *E. p. perotis*.

**Table 20. Selected sample statistics of *Eumops trumbulli***

| | Male | | | Female | | |
|---|---|---|---|---|---|---|
| Character | n | $\bar{X}$ | ±S.E. | n | $\bar{X}$ | ±S.E. |
| FOAR | 20 | 71.55 | 0.41 | 31 | 70.22 | 0.26 |
| TOLG | 18 | 29.19 | 0.20 | 21 | 28.31 | 0.15 |
| CBLG | 17 | 27.89 | 0.19 | 18 | 26.86 | 0.17 |
| ZYGO | 18 | 16.67 | 0.16 | 20 | 16.18 | 0.07 |
| MAST | 14 | 14.32 | 0.09 | 16 | 13.92 | 0.09 |
| HBCA | 16 | 8.67 | 0.07 | 18 | 8.53 | 0.06 |
| C-$M^3$ | 22 | 11.35 | 0.06 | 26 | 11.09 | 0.06 |
| POCO | 19 | 4.92 | 0.05 | 25 | 4.86 | 0.04 |

### Remarks

Since the review of Sanborn (1932), the status of *E. trumbulli* has been questionable. Sanborn (1949) and Smith and Genoways (1969) considered *E. trumbulli* to be a distinct species, whereas Koopman (1971) inferred that it should be considered a race of *E. perotis*. The geographic range of these taxa are allopatric, but multivariate analyses indicate that greater differences exist between *E. perotis* and *E. trumbulli* than between *E. auripendulus* and *E. underwoodi*.

### Specimens Examined and Distribution Records

BOLIVIA. Beni: Guayaramerín, 10°51′S 65°23′W, 4 (AMNH). BRAZIL. Amazonas: Rio Juruá, 3°27′S 66°03′W, 1 (USP); Manacapuru, 3°18′S 60°37′W, 1 (BMNH); Manaus, 3°08′S 60°01′W, 1 (IRSNB); mouth of Lake Tefé, 3°27′S 64°47′W, 2 (AMNH). Pará: Belém, 1°27′S 48°29′W, 1 (BMNH); Cametá, Rio Tocantins, 2°15′S 49°30′W, 3 (MCZ); Ilha do Taiuna, Rio Tocantins, 1 (AMNH); Marajó, Caldeirão, 0°45′S 56°13′W, 4 (BMNH); Mocajuba, Rio Tocantins, 2°36′S 49°29′W, 8 (AMNH); Vilarinho do Monte, Rio Xingu, 1°37′S 52°01′W, 2 (AMNH). COLOMBIA. Amazonas: Leticia, 4°09′S 69°57′W, 7 (ROM); Puerto Nariño, 50 km NW Leticia, 4°56′N 67°48′W, 2 (USNM). Meta: Puerto López, 4°05′N 72°58′W, 9 (ROM), 4 (USNM). GUYANA. Essequibo, Rupununi: Tamtoon House, 2°20′N 59°40′W, 1 (ROM); Quash Wau, 16 km N Dadanawa, 2°55′N 59°30′W, 2 (ROM); Rewa River, 3°20′N 58°40′W, 1 (ROM); Droop Wau, 2°45′N 59°30′W, 1 (ROM); Sand Creek Indian Reservation, 3°00′N 59°35′W, 1 (ROM). PERU. Loreto: Alto Río Tamaya, 8°59′S 73°19′W, 1 (FMNH); Iquitos, 3°51′S 73°13′W, 2 (UNAM); Yarinacocha, Río Ucayali (Sanborn, 1949), 4 (FMNH). SURINAM. Surinam: Zanderij, 5°26′N 55°14′W, 1 (RMNH). VENEZUELA. Bolívar: Maripa, 7°22′N 65°09′W, 4 (KU).

## *Eumops underwoodi* Goodwin, 1940

*Eumops underwoodi* Goodwin, 1940: 2.

### Distribution

Southern Arizona south to Honduras (Fig. 19).

### Diagnosis

Size large; ears small; tragus small, rounded; skull heavy, robust; basisphenoid pits moderately well developed, oval, shallow; third commissure of $M^3$ rudimentary; pelage Cinnamon Brown to Mummy Brown dorsally, paler ventrally.

### Differential Diagnosis

Distinct species with skull shorter and more robust and basisphenoid pits about one-half the size of those of *E. perotis*.

## *Eumops underwoodi underwoodi* Goodwin, 1940

*Eumops u. underwoodi* Hall and Villa, 1949: 446.

**Holotype**
AMNH 126862 adult male; El Pedrero, 6 km north of Chinaela, La Paz, Honduras.

**Distribution**
Honduras, Belize, north to Chihuahua, Mexico (Fig. 19).

**Diagnosis**
See drawing (Fig. 28). Pelage Cinnamon Brown to Mummy Brown. See Table 21 for selected character means.

**Differential Diagnosis**
Similar to *E. u. sonoriensis*, but body size, forearm, and skull are larger.

**Specimens Examined and Distribution Records**
BELIZE. Corozal: 4.8 km W Corozal, 18°23′N 88°23′W, 3 (LSU). HONDURAS. La Paz: El Pedrero, 6 km N Chinaela, 14°20′N 87°40′W, 4 (AMNH). MEXICO. Chiapas: 19.2 km E Ortiz Rubio on Villa Flores Rd., 16°15′N 93°12′W, 3 (UA); 10 km SE Tonalá, 16°08′N 93°41′W, 1 (UNAM); Rancho San Fernando, 42 km W Cintalapa, 1 km W San Miguel, 16°10′N 92°43′W, 5 (UA); 5–8 km N Arriaga, 16°15′N 93°52′W, 2 (TCWC). Chihuahua: Naranjo, 27°15′N 107°55′W, 1 (LACM). Colima: Las Juntas, 26 km W Pueblo Juárez, 19°10′N 104°14′W, 1 (UNAM), 1 (UA); Río Armería, 8 km N Tecomán, 19°00′N 105°50′W, 1 (LSU). Jalisco: Juntas del Salitre, 6 km N Soyatlán del Oro, 20°30′N 103°40′W, 2 (UA); 9 km NW Cuautla, 20°10′N 104°20′W, 1 (KU); 3 km NE Talpa, 20°22′N 104°50′W, 8 (KU). Michoacán: Tancitario Mt., Rancho Escondido, 3.2 km N Apo, 19°26′N 102°18′W, 2 (UMMZ). Morelos: Palo Bolero, 18°44′N 99°13′W, 1 (UNAM). Oaxaca: 4.8 km S Nejapa, 16°37′N 95°57′W, 1 (KU); Río Jalatengo, km 178 on Puerto Angel Rd., 15°50′N 96°35′W (Arnold and Schonewald, 1972). Tabasco: 20 km N Balancán, 17°50′N 91°35′W, 4 (LSU).

**Table 21. Selected sample statistics of *Eumops u. underwoodi***

| | Male | | | Female | | |
|---|---|---|---|---|---|---|
| Character | n | $\bar{X}$ | ±S.E. | n | $\bar{X}$ | ±S.E. |
| FOAR | 8 | 71.72 | 0.53 | 32 | 71.25 | 0.26 |
| TOLG | 7 | 31.13 | 0.40 | 23 | 30.22 | 0.11 |
| CBLG | 7 | 29.41 | 0.25 | 22 | 28.54 | 0.09 |
| ZYGO | 6 | 18.47 | 0.29 | 23 | 17.98 | 0.07 |
| MAST | 6 | 16.22 | 0.20 | 22 | 15.78 | 0.06 |
| HBCA | 7 | 10.04 | 0.32 | 21 | 9.95 | 0.08 |
| C-$M^3$ | 7 | 12.11 | 0.09 | 24 | 11.76 | 0.06 |
| POCO | 7 | 5.86 | 0.09 | 24 | 5.67 | 0.03 |

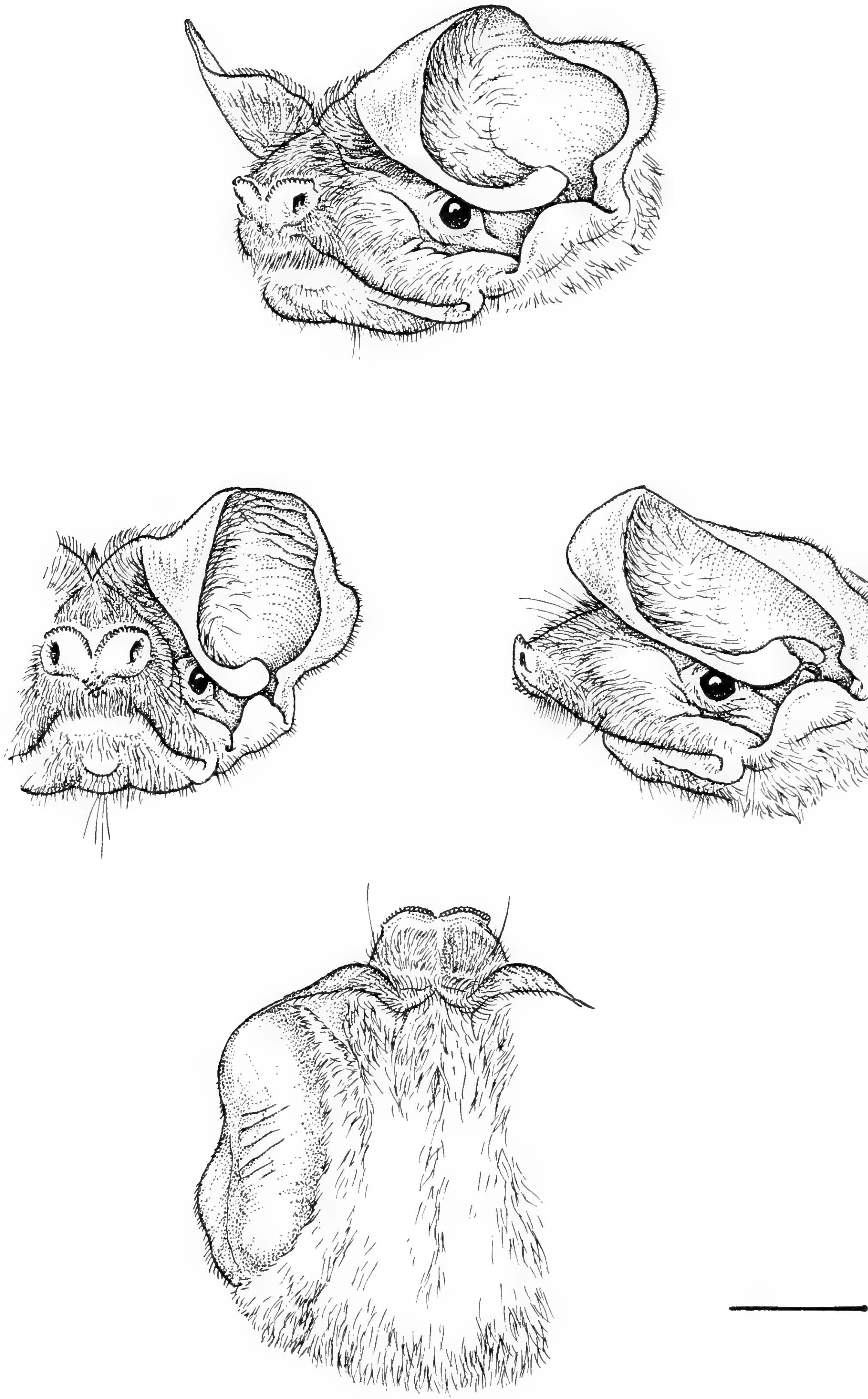

Fig. 28. *Eumops u. underwoodi.* Scale bar = 10 mm.

## *Eumops underwoodi sonoriensis* Benson, 1947

*Eumops sonoriensis* Benson, 1947: 133.
*Eumops underwoodi sonoriensis* Hall and Villa R., 1949: 446.

**Holotype**
MVZ 82150 adult male; Rancho de Costa Rica, Rio Sonora, Sonora, Mexico.

**Distribution**
Southern Arizona; state of Sonora, Mexico (Fig. 19).

**Diagnosis**
Pelage Sayal Brown to Bister dorsally, paler ventrally. See Table 22 for character means.

**Differential Diagnosis**
Similar to *E. u. underwoodi*, but body, forearm, and skull lengths smaller.

**Specimens Examined and Distribution Records**
MEXICO. Sonora: 32 km N Guymas, 27°59′N 110°54′W, 1 (UA); 2 km SW Matorrena, 28°05′N 110°45′W, 6 (LACM); 16 km NW Noche Buena, approx. 28°N 111°W, 4 (MVZ); Rancho de Costa Rica, Río Sonora, 1 (UNAM), 6 (MVZ); 1 km SE 1A, Colorado, 28°05′N 110°45′W, 1 (TTU); 1 km W San José de Guaymas, 27°44′N 110°46′W, 1 (TTU). UNITED STATES. Arizona: Maricopa Co., Deer Valley School, 6.4 km (4 mi) N Sun City on Lake Pleasant Road, 33°43′N 112°30′W, 1 (MSB); Pima Co., Garcia Represso, 3.2 km (2 mi) E Sasabe, 31°31′N 111°31′W, 7 (UA), 2 (USNM), 1 (KU), 1 (LSU); Papago Reservation, 1.6 km (1 mi) N Mexican Boundary # 143, 1 (UA); 1.6 km (1 mi) N, 18.4 km (11.5 mi) E Topawa, 31°50′N 111°48′W, 2 (UI).

**Table 22. Selected sample statistics of *Eumops underwoodi sonoriensis***

| | Male | | | Female | | |
|---|---|---|---|---|---|---|
| Character | n | $\bar{X}$ | ± S.E. | n | $\bar{X}$ | ± S.E. |
| FOAR | 17 | 68.61 | 0.48 | 11 | 67.51 | 0.59 |
| TOLG | 20 | 28.92 | 0.12 | 12 | 28.37 | 0.16 |
| CBLG | 20 | 27.70 | 0.10 | 12 | 27.11 | 0.17 |
| ZYGO | 20 | 17.39 | 0.08 | 12 | 16.92 | 0.11 |
| MAST | 20 | 15.20 | 0.06 | 12 | 14.92 | 0.11 |
| HBCA | 20 | 9.26 | 0.09 | 12 | 9.11 | 0.15 |
| C-$M^3$ | 20 | 11.51 | 0.05 | 12 | 11.42 | 0.09 |
| POCO | 20 | 5.50 | 0.04 | 12 | 5.42 | 0.04 |

## *Nomenclatural Recommendations*

The classification presented here summarizes the phenetic relationships for *Eumops* as determined by the preceding analyses: *E. auripendulus*, consisting of two allopatric taxa; *E. bonariensis*; *E. dabbenei*, a monotypic species allied with *E. glaucinus, E. underwoodi*, and *E. auripendulus*, not a subspecies of *E. perotis*; *E. glaucinus*, with two allopatric subspecies; *E. hansae*; *E. maurus*; *E. perotis*, with two allopatric subspecies; and *E. trumbulli*. In the past the specific status of *E. trumbulli* has been questioned. Sanborn (1932) referred to *E. trumbulli* as a subspecies of *E. perotis*, whereas Smith and Genoways (1969) referred to this taxon as a species. There is no doubt that these two taxa are aligned, for they belong to the same phenetic cluster, are allopatric, and, according to Brown (1967), are the only members of the genus that lack an *os penis*, but substantial phenetic differences exist between them, as is shown in the preceding analyses. Moreover, *E. perotis* shows a reduction in the third upper molar not found in *E. trumbulli*. In other species of the genus, this dental character was consistent within each species.

## *Key to Species and Subspecies of Eumops*

Measurements (mm) given are means and extremes.

1. Forearm length less than 55; cranial length less than 22 . . . . . . . . . . . . . . . . 2

1′ Forearm length greater than 55; cranial length greater than 22 . . . . . . . . . . 4

2. A band of white hair (*ca*. 5 mm wide) between humerus and femur on ventral surface of mesopatagium proximal to body; remainder of body dark Chocolate; forearm length 51–53 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. maurus*

2′ No white band on ventral surface of mesopatagium; forearm length less than 50 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 3

3. Dorsal pelage rich Blackish Brown; ventral pelage white at base; basisphenoid pits deep and long; forearm length 37–41.2; cranial length more than 45 per cent of forearm length . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. hansae*

3′ Dorsal pelage Snuff Brown to Bister; basisphenoid pits shallow and small; forearm length 36.9–49.4; cranial length less than 45 per cent of forearm length . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. bonariensis*

Forearm length 46.8 (43.5–49); cranial length 20.3 (19.6–20.9); Uruguay south to the region of Buenos Aires in Argentina . . . . . *E. b. bonariensis*

Forearm length 44.1 (41.1–46.6); cranial length 18.1 (16.7–19); Bolivia, Paraguay, and northern Argentina . . . . . . . . . . . . . . . . . . . . *E. b. beckeri*

Forearm length 46.1 (45.2–49.4); cranial length 18.6 (18.2–18.8); Amazonian region of central Brazil and Colombia . . . . . . . . . . . . . . *E. b. delticus*

Forearm length 39.4 (36.9–43.2); cranial length 16.8 (15.7–18.1); southern Mexico, Honduras, Panama, northern Colombia, Venezuela, Guyana, and northern Peru . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. b. nanus*

4. Ears long, 39.6 (35–44); tragus large, broad and square; basisphenoid pits deep and elongate; mastoid width less than 52 per cent of condyloincisive length . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5

4′ Ears short, generally less than 35 (17–34); tragus small, pointed or square; basisphenoid pits shallow; mastoid width greater than 52 per cent of condyloincisive length . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 6

5. Third commissure of $M^3$ one-fourth length of second . . . . . . . . . . *E. perotis*

Forearm length 79.9 (73.9–83.3); cranial length 32.6 (31.5–34.4); lachrymal width 10.5 (9.2–11.5); northern Venezuela, southern Brazil, northern Argentina, Paraguay, Bolivia, and east of the Andes in Ecuador, and Peru . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. p. perotis*

Forearm length 75.6 (72–82.7); cranial length 31.8 (30–33.3); lachrymal width 9.4 (8.5–10.5); southern regions of California, Arizona, New Mexico, Texas, and northern Mexico . . . . . . . . . . . . . *E. p. californicus*

5′ Third commisure of $M^3$ one-half length of second; forearm length 70.9 (67.4–75); cranial length 28.7 (26.8–31); lachrymal width 8.1 (7.3–9.1) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. trumbulli*

6. Size larger, cranial length greater than 28 (males) and 27 (females); ear heavily keeled; dorsal pelage Cinnamon with buff basal band . . . . . . . . . . 7

6′ Size smaller, cranial length less than 28 (males) and 27 (females); pelage Snuff Brown to Sepia (with white basal band) or Blackish Brown; ear not heavily keeled . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 8

7. Forearm length 77.1 (74.5–79); cranial length 33.8 (32.1–34.8); cranial length greater than 32 (females only); known only from South America . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. dabbenei*

7′ Forearm length 69.7 (64.3–76.1); cranial length less than 32 (females) and 33 (males); known only from Honduras north to Arizona and New Mexico . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. underwoodi*

Forearm length 71.5 (68.7–76.1); cranial length males 31.1 (30.1–32.6), females 30.2 (29.3–31.4); Honduras, Belize, southern Mexico north to Chihuahua . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. u. underwoodi*

Forearm length 68.1 (64.3–73.5); cranial length males 28.9 (28–29.9), females 28.4 (27.3–29); southern Arizona and state of Sonora, Mexico . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. u. sonoriensis*

8. Tragus small and pointed; dorsal pelage Blackish Brown; basisphenoid pits shallow; mastoid width less than 49 per cent of cranial length . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. auripendulus*

Forearm length 58.5 (55–62.9); cranial length 24.9 (23.4–26.5); Jamaica, southern Mexico south to central Peru and Bolivia . . *E. a. auripendulus*

Forearm length 63.9 (60.6–68); cranial length 27.9 (25.6–27.8); northern Argentina, Paraguay, and eastern Brazil . . . . . . . . . . . . . . . . *E. a. major*

8′ Tragus broad and square; dorsal pelage Snuff Brown to Bister with white basal band; basisphenoid pits well defined; mastoid width greater than 52 per cent of cranial length . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. glaucinus*

Forearm length 59.4 (55.7–62.2); cranial length 24.4 (22.8–25.8); central Mexico, south to Peru, Bolivia, Paraguay, southeastern Brazil, Jamaica, and Cuba . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. g. glaucinus*

Forearm length (males only) 64.3 (62.5–67.7); cranial length (26.3–27.7); Miami area, Florida . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. g. floridanus*

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## *Summary*

Sexual dimorphism in bats of the genus *Eumops* was analyzed using 38 characters and was evident in all taxa studied. Males were larger than females in all characters except length of tibia; and lengths of canines, mandible, and skull were consistently dimorphic characters.

Multivariate statistical techniques were used to evaluate 32 morphometric characters and to determine phenetic affinities among nine species of the genus. Phenetic relationships are presented in phenograms and in two- and three-dimensional models of operational taxonomic units (OTUs) projected onto principal components based on a matrix of correlations among characters. Similarities between pairs of OTUs were determined by average taxonomic distances and correlation coefficients. In some analyses metric data were divided by forearm length to reduce the effect of size. In another analysis the influence of size was reduced by removing the effect of the first principal component from the distances.

Five different phenograms were compared. Using distances without reducing the effect of size only resulted in grouping of taxa of similar size. Correlations and distances with size effect reduced, produced similar results. Principal components analyses established relationships of taxa out of the confines of hierarchical clustering.

Studies of geographic variation in *Eumops auripendulus* suggest that *E. a. auripendulus* consists of a number of variable populations and confirm the presence of two subspecies, *E. a. auripendulus* and *E. a. major*. Likewise, *E. glaucinus* consists of two subspecies, *E. g. glaucinus* and *E. g. floridanus*, with the former also composed of numerous populations.

Based on phenetic groupings and systematic data, I suggest that the following species of *Eumops* be recognized:

*Eumops auripendulus*, with two allopatric subspecies, *E. a. auripendulus* and *E. a. major*.

*E. bonariensis*, probably a polytypic species.

*E. dabbenei*, a monotypic species allied with *E. auripendulus* and *E. underwoodi* rather than a subspecies of *E. perotis*, as so treated by previous reviewers.

*E. glaucinus*, with two allopatric subspecies, *E. g. glaucinus* and *E. g. floridanus*.

*E. hansae*, a monotypic species, including *E. amazonicus* as a synonym.

*E. maurus*, a monotypic species, including *E. geijskesi* as a synonym.

*E. perotis*, with two allopatric subspecies, *E. p. perotis* and *E. p. californicus*.

*E. trumbulli*. *E. perotis* and *E. trumbulli* are closely aligned allopatric taxa but are sufficiently distinct to be considered different species.

*E. underwoodi*, probably a polytypic species.

# *Resumen*


El dimorfismo sexual se analizó usando 38 características y se encontró tal dimorfismo en todos los grupos de *Eumops* estudiados, siendo cada uno dimórfico en diez o más de los parámetros analizados. La longitud de los caninos, de la mandíbula y del cráneo son características dimórficas consistentes. Los machos son de mayor tamaño que las hembras en todas estas características exceptuando la longitud de la tibia.

Técnicas estadísticas multivariadas se utilizaron para evaluar 32 caracteres morfométricos y para determinar las afinadades fenéticas entre las divisiones taxonómicas del género. Estas relaciones fenéticas se presentan en fenogramas. Las unidades taxonómicas operacionales (OTU) se proyectan en los primeros dos y tres componentes principales, basándose en una matriz de correlaciones entre caracteres. Las similaridades entre pares de unidades taxonómicas operacionales se determinaron usando promedios de distancias taxonómicas y coeficientes de correlación. En algunos de los análisis, los datos fueron divididos por la longitud del antebrazo para reducir el efecto del tamaño. En otro análisis, la influencia del tamaño se redujó eliminando el efecto del primer componente principal de las distancias taxonómicas.

Se compararon cinco fenogramas diferentes. Usando distancias sin reducir el tamaño sólo se obtuvieron aglomeraciones de grupos taxonómicos de tamaño similar. Correlaciones y distancias con tamaños disminuídos produjeron resultados similares.

El análisis de funciones discriminativas se usó para estudiar la variación geográfica de *Eumops auripendulus*. Los ejemplares se dividieron en muestras representativas de 10 localidades diferentes. Los resultados indican que las relaciones fenotípicas entre dichas localidades más o menos muestran lo que se encontraría considerando la distancia y la posición geográfica relativa entre dichas localidades. Los ejemplares de Brasil oriental y de Argentina difieren de las poblaciones restantes ya que son considerablemente de mayor tamaño.

De la misma manera, los ejemplares de *E. glaucinus* fueron alocados en muestras correspondientes a ocho localidades diferentes.

El análisis de funciones discriminantes y el análisis estadístico SS-STP (Sum of Squares Simultaneous Test Procedure) de cinco de las características indica que esta especie consiste de razas diferentes: *E.glaucinus floridanus* de Florida, Estados Unidos, y *E. g. glaucinus* de América Central y América del Sur.

Las relaciones taxonómicas del género fueron examinadas usando diferentes métodos de taxonomía numérica. Dichos estudios indican que el coeficiente de correlación es una medida apropiada para agrupar dichas especies en un orden lógico.

Según las agrupaciones fenéticas obtenidas, sugiero que se reconozcan las siguientes especies:

*Eumops auripendulus*, con dos subespecies alopátricas, *E. a. auripendulus* y *E. a. major*.

*E. bonariensis*, probablement una especie politípica.

*E. dabbenei*, especie monotípica, más relacionada con *E. auripendulus* y *E. underwoodi* en vez de ser una subespecie de *E. perotis* como ha sido tratada previamente por otros autores.

*E. glaucinus*, con dos subespecies alopátricas, *E. g. glaucinus* y *E. g. floridanus*.

*E. hansae*, especie monotípica que incluye *E. amazonicus* como un sinónimo.

*E. maurus*, especie monotípica que aquí incluye *E. geijskesi* como un sinónimo.

*E. perotis*, consta de dos subespecies alopátricas, *E. p. perotis* y *E. p. californicus*.

*E. trumbulli*. *E. perotis* y *E. trumbulli*, íntimamente relacionadas, alopátricas, con diferencias significantes que se consideran como especies diferentes.

*E. underwoodi*, probablemente una especie politípica.

La siguiente clave puede usarse para simplificar la identificación de las divisiones taxonómicas del género *Eumops*.

1. Antebrazo menor de 55 mm; longitud craneal menor de 22 mm . . . . . . . . . 2

1′ Antebrazo mayor de 55 mm; longitud craneal mayor de 22 mm . . . . . . . . . 4

2. Una banda de pelo blanco (*ca.* 5 mm de anchura) presente entre el húmero y el fémur en la superficie ventral del mesopatagio, próxima al cuerpo; el resto del pelaje del cuerpo de color Chocolate obscuro; antebrazo de 51–53 mm . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. maurus*

2′ Banda blanca ausente en la superficie ventral del mesopatagio; antebrazo menor de 50 mm . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 3

3. Pelaje del dorso color negro pardusco (Blackish Brown); pelaje del vientre blanco en la base; concavidades basiesfenoidales largas y profundas; antebrazo 37–41.2 mm; longitud craneal mayor de 45 por ciento de la longitud del antebrazo . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. hansae*

3′ Pelaje dorsal de color canela rojizo o canela obscuro (Snuff Brown a Bister); concavidades basiesfenoidales poco profundas y pequeñas; antebrazo 36.9–49.4 mm; longitud craneal menor de 45 por ciento de la longitud del antebrazo . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. bonariensis*

Antebrazo 46.8 (43.5–49) mm; longitud craneal 20.3 (19.6–20.9) mm; desde Uruguay hasta el sur de la región de Buenos Aires, Argentina . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. b. bonariensis*

Antebrazo 44.1 (41.1–46.6) mm; longitud craneal 18.1 (16.7–19) mm; Bolivia, Paraguay y norte de Argentina . . . . . . . . . . . . . . . . *E. b. beckeri*

Antebrazo 46.1 (45.2–49.4) mm; longitud craneal 18.6 (18.2–18.8) mm; región amazónica de Brasil central y Colombia . . . . . . . . . . *E. b. delticus*

Antebrazo 39.4 (36.9–43.2) mm; longitud craneal 16.8 (15.7–18.1) mm; sur de México, Honduras, Panamá, norte de Colombia, Venezuela, Guayana y norte del Perú . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *E. b. nanus*

4. Orejas largas, 39.6 (35–44) mm; trago grande, ancho, cuadrangular; concavidades basiesfenoidales profundas y elongadas; anchura mastoidea menos del 52 por ciento de la longitud condilobasal . . . . . . . . . . . . . . . . . . 5

4′ Orejas cortas, generalmente menores de 35 (17–34) mm; trago pequeño, puntiagudo o cuadrangular; concavidades basisesfenoidales pandas; anchura mastoidea mayor de 52 por ciento de la longitud condilobasal . . . . . 6

5. Tercera comisura de $M^3$ un cuarto de la longitud de la segunda ... *E. perotis*
Antebrazo 79.9 (73.9–83.3) mm; longitud craneal 32.6 (31.5–34.4) mm; anchura lacrimal 10.5 (9.2–11.5) mm; norte de Venezuela, sur de Brasil, norte de Argentina, Paraguay, Bolivia y este de la cordillera de los Andes en Ecuador y Perú .................................... *E. p. perotis*
Antebrazo 75.6 (72–82.7) mm; longitud craneal 31.8 (30–33.3) mm; anchura lacrimal 9.4 (8.5–10.5) mm; regiones del sur de California, Arizona, Nuevo México, Texas en los Estados Unidos y norte de México ............................................. *E. p. californicus*

5′ Tercera comisura de $M^3$ la mitad de la longitud de la segunda; antebrazo 70.9 (67.4–75) mm; longitud craneal 28.7 (26.8–31) mm; anchura lacrimal 8.1 (7.3–9.1) mm ............................................. *E. trumbulli*

6. Tamaño mayor; longitud craneal mayor de 28 mm (en machos) y 27 mm (en hembras); orejas bien quilladas; pelaje dorsal de color canela (Cinnamon) con una banda amarilla leve basalmente ............................ 7

6′ Tamaño menor; longitud craneal menor de 28 mm (en machos) y 27 mm (en hembras); pelaje gris canela (Snuff Brown a Sepia) con banda basal blanca o canela negruzco (Blackish Brown); orejas ligeramente quilladas ........ 8

7. Antebrazo 77.1 (74.5–79) mm; longitud craneal 33.8 (32.1–34.8) mm, mayor de 32 sólo en hembras; conocida solamente de América del Sur ................................................ *E. dabbenei*

7′ Antebrazo 72 (69.7–76.1) mm; longitud craneal menor de 32 mm (en hembras) y 33 (en machos); conocida solamente de Honduras hasta el sur de Arizona ............................................ *E. underwoodi*
Antebrazo 71.5 (68.7–76.1) mm; longitud craneal en machos 31.1 (30.1–32.6) mm, en hembras 30.2 (29.3–31.4) mm; de Honduras, Belize, sur de México hasta Chihuahua en el norte .......... *E. u. underwoodi*
Antebrazo 68.1 (64.3–73.5) mm; longitud craneal en machos 28.9 (28–29.9) mm, en hembras 28.4 (27.3–29) mm; sur de Arizona y Estado de Sonora, México ................................ *E. u sonoriensis*

8. Trago pequeño y puntiagudo; pelaje dorsal canela negruzco (Blackish Brown); concavidades basiesfenoidales pandas; anchura mastoidea menor de 49 por ciento de la longitud total del cráneo .......... *E. auripendulus*
Antebrazo 58.5 (55–62.9) mm; longitud craneal 24.9 (23.4–26.5) mm; sur de México hasta Bolivia y la región amazónica del Brasil y Jamaica ............................................. *E. a auripendulus*
Antebrazo 63.9 (60.6–68) mm; longitud craneal 27.9 (25.6–27.8) mm; norte de Argentina, Paraguay y este del Brasil ................. *E. a major*

8′ Trago ancho y cuadrangular en su extremidad distal; pelaje dorsal de color canela grisaseo (Snuff Brown a Bister) con banda blanca basal; concavidades basiesfenoidales bien definidas; anchura mastoidea mayor de 52 por ciento de la longitud total del cráneo ................. *E. glaucinus*
Antebrazo 59.4 (55.7–62.2) mm; longitud craneal 24.4 (22.8–25.8) mm; desde el centro de México hasta el sur del Perú, Bolivia, Paraguay, sureste del Brasil, Jamaica y Cuba ......................... *E. g. glaucinus*
Antebrazo (sólo machos) 64.3 (62.5–67.7) mm; longitud craneal 26.9 (26.3–27.7) mm; región de Miami, Florida, Estados Unidos ........................................... *E. g. floridanus*

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